Electric Railway Review

FORMERLY THE STREET RAILWAY REVIEW

The name of this publication was changed with the July, 1906, issue. This index includes the subjects appearing in the Street Railway Review, January to June, 1906, and in the Electric Railway Review, July to December, 1906.

VOLUME XVI

January to December, 1906

THE WILSON COMPANY
Monadnock Block
Chicago

GENERAL INDEX

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STREET RAILWAY REVIEW

Vol. XVI JANUARY 15, 1906 No. 1

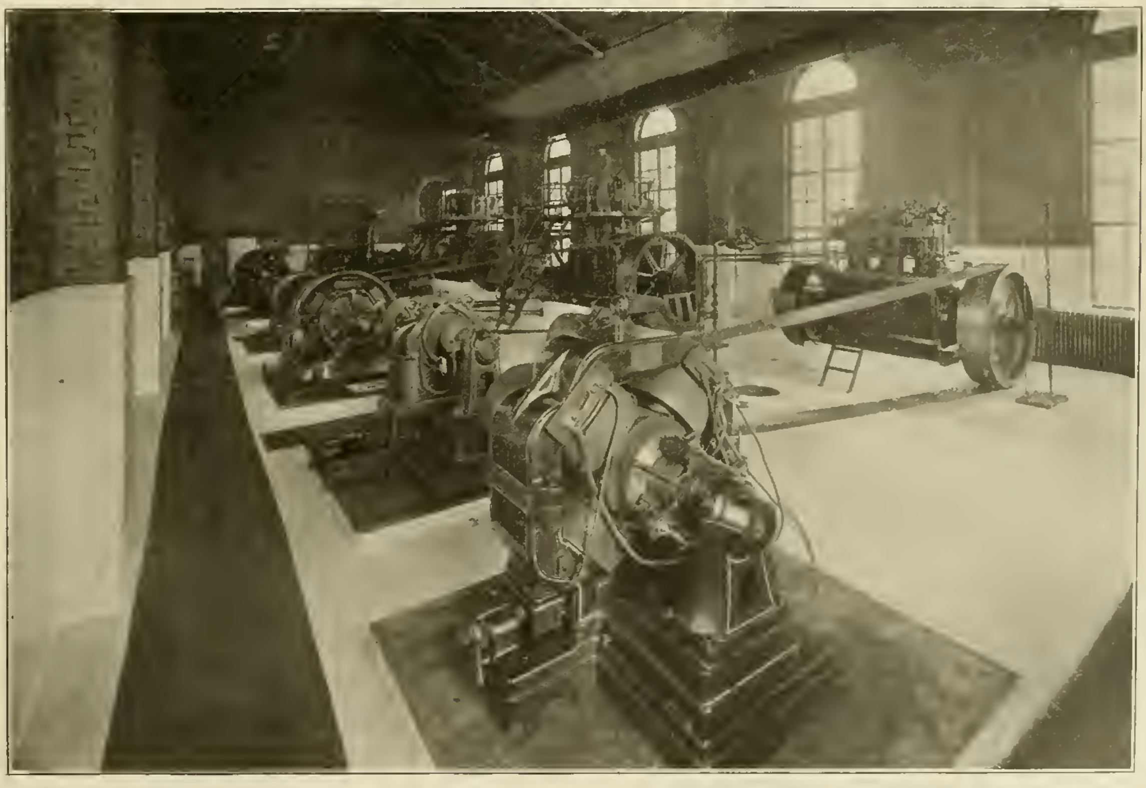
Reconstruction Work of the Madison & Interurban Traction Co.

Being a Description of a City System That Has Been in Operation 20 Years, and Has Practically Been Rebuilt During the Past Summer.

The question of deciding at what time the best financial returns will be obtained by reconstructing lines which have been operating for some years in cities of medium size, is one of much interest. This article, which we are pleased to present, describes such a reconstructed line, a road which has been operated by five different companies, and also was at one time in the hands of a receiver. The present owner of the property came into control less than a year ago, and immediately set to work to improve the roadbed, equipment and general operating system. A large part of this work has lately been completed, and during the last few months the earnings have substantially proved the wisdom of the added investment necessary for reconstruction.

As early as 1884 the first rails in Madison were laid by the Madison Street Railway Co., which operated its then small system by mule power. This line in 1883 was transferred to the Madison City Railway Co., but owing to financial troubles soon went into the hands of a receiver, who operated it for three years. The property was then deeded to Mr. H. R. Newcomb, of Cleveland, O., and his associates, as trustees. These gentlemen soon organized the Madison Electric Railway Co. and transferred the property to that company for operation. In 1901 Mr. P. L. Spooner and his associates organized the Madison Traction Co. and purchased all the holdings of the Madison Electric Railway Co. The property was controlled by Mr. Spooner until the spring of 1905, when it was purchased by Mr. F. W. Montgomery, who organized the Madison & Interurban Traction Co., which now owns all the electric railway franchises and property rights in Madison.

The lines were equipped for operation by trolley in October, 1892. During the last few years the roadbed has been maintained in a satisfactory operating condition, but due to its long use was not considered sufficiently substantial for economical operation with the increased schedules and weight of cars which the traffic now demands. Realizing this condition, the new management immediately set about to rebuild all the track in an especially thorough and substantial manner, so that when the present period of reconstruction closes the roadbed will be built of heavy rails laid on concrete and broken stone.

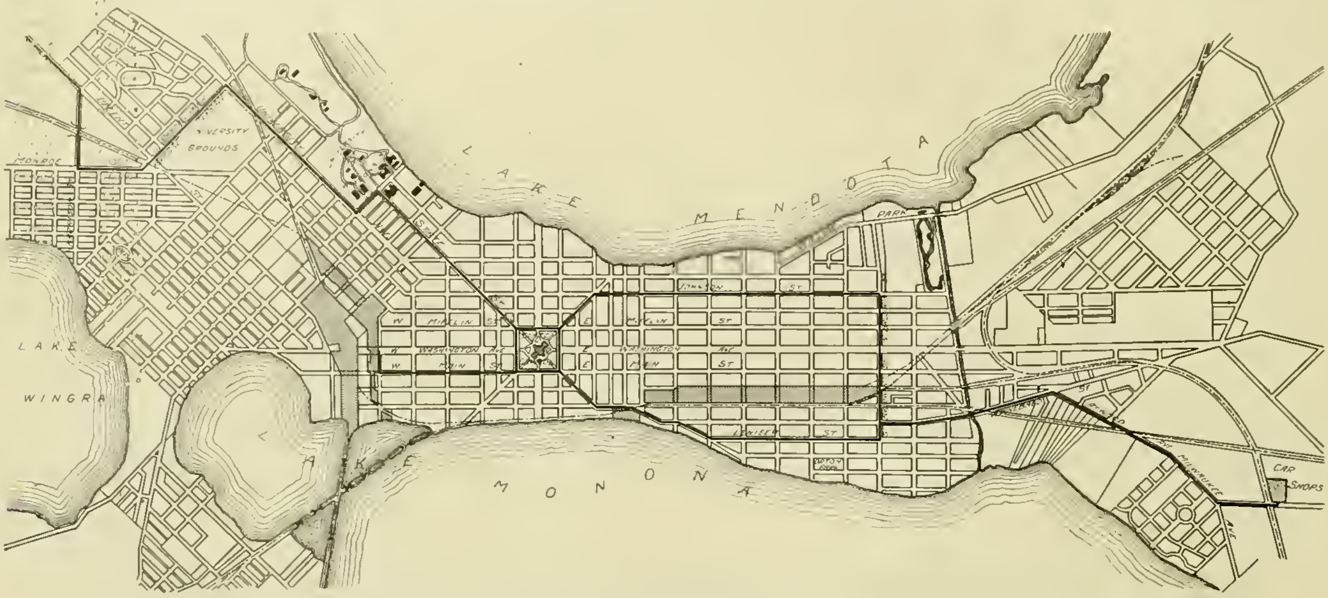


POWER HOUSE AT MADISON WITH GAS ENGINES FOR DRIVING RAILWAY GENERATORS.

Roadbed.

The city of Madison is bounded on two sides by the shores of lakes which make possible the growth of the city in but two

directions. These physical features are illustrated in the accompanying map, showing the routes of the electric railway. It will also be seen that the peculiar location of the city allows the entire population to be served by a comparatively small amount of trackage. At present there is a total of 11 miles of roadbed, to which during the coming summer will be added 4 more miles. This roadbed is built with single track and turnouts 1,000 ft. long. The generous



MAP OF MADISON, WIS., SHOWING THE LINES OF THE MADISON & INTERURBAN TRACTION CO.

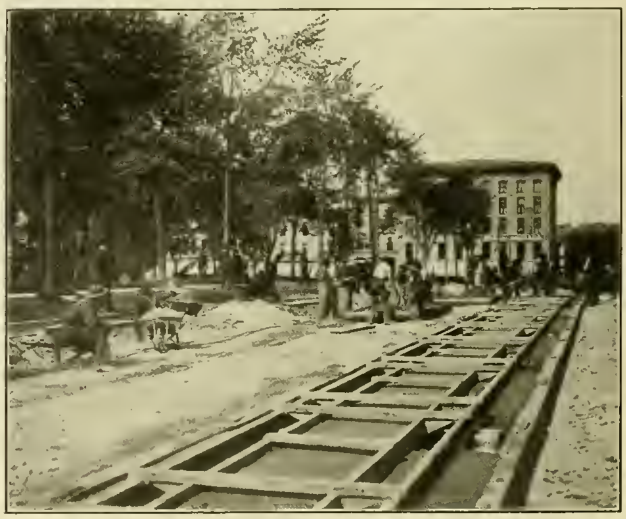
length of passing tracks materially aids in keeping the cars on time. In the center of the business portion of the city is the Wisconsin state capitol building, located in a square 800 ft. on a side, the four main branches of the city lines approaching this square on radial streets.

The old line was built with double track on three sides of the capitol square, leaving the street on the fourth side unoccupied. With this arrangement satisfactory operation was best effected by using the Y at the northwest corner as a transfer point. When

RAILS SURFACED READY FOR CONCRETE BED.

planning for the reconstruction of the track about the square it was thought best to do away with the double track and build a single track on all four sides of the square, and curves at the intersections connecting with the single-track lines from the four incoming lines on the radial streets. With the track as it now is on four sides of the square, the transfer point is done away with and cars are operated from one end of the city to the other, always passing around the right-hand side of the capitol square. As the cars on all routes pass along two sides of this square, the transfer problem is much simplified and all schedules are not delayed if the cars on any one route are late.

The roadbed construction in the business portion of the city is built according to a design which is especially interesting. The rails, which are in 62-ft. lengths weighing 72 lb. to the yard, and of a 6-in. high T section, are supported by a continuous concrete arch-shaped foundation, combining the trench and flat-bed types of construction. The dimensions of this track foundation are shown on an accompanying cross section of the single-track roadbed. The streets in which this type of track is built are paved with asphalt, using granite blocks adjacent to the rails. The upper surface of the concrete bed was shaped by means of portable forms, so that the portion confined by the gage blocks between the two rails is brought up higher than the base of the rails, thus forming a substantial concrete sub-base for the asphalt and binder between the track rails. Anchors placed in the concrete 10 ft. apart and made of two ½ x 10-in. bolts and

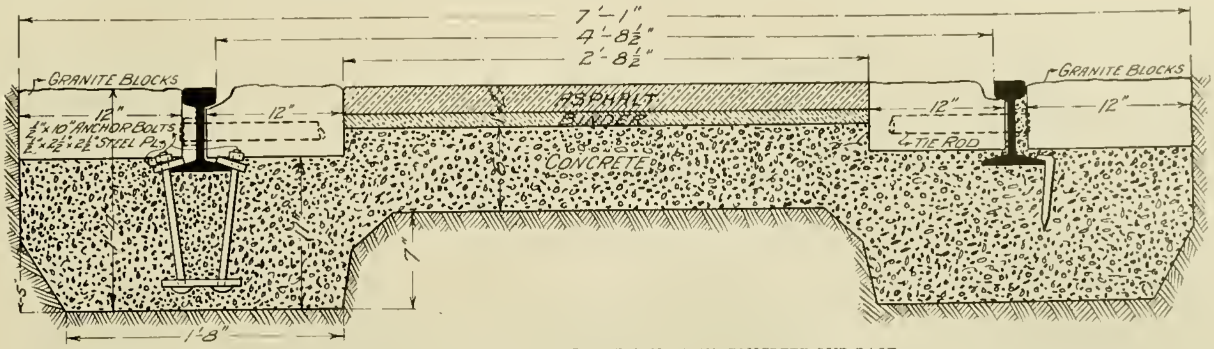


FORM FOR MOULDING CONCRETE BED.

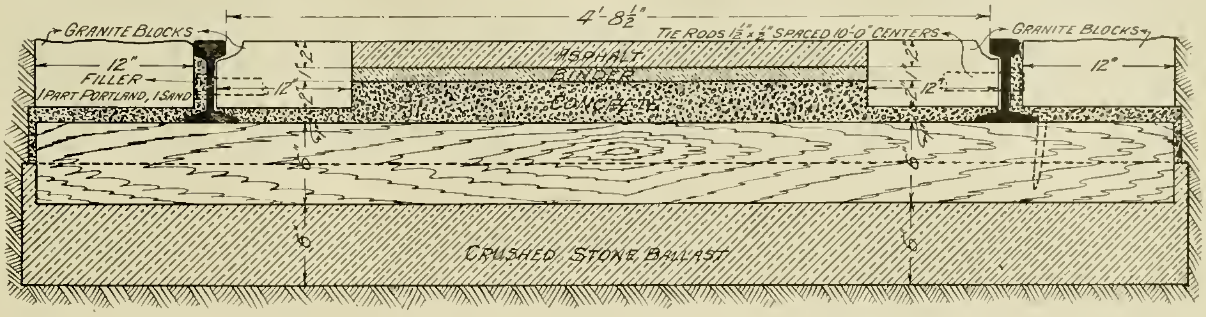
½-in. plates, are spaced opposite each other. Between the anchors the rails are held down to the concrete by ordinary track spikes placed 2 ft. apart on alternate sides of the base of the rail. The granite paving blocks are all of the same size, 12 x 5 x 6 in., and all laid as headers, giving a stone-paved surface outside of the rails to the limits of the space which the railway company must maintain.

The three important stages in construction of this track are shown in the accompanying illustrations. After the trenches have been ex-

cavated to the desired dimensions the rails are mounted on temporary blocks, tie rods put on and the track brought to line and surface. Next the permanent anchors with their clips are hung from the base of the rails, the concrete is filled in the trench and hand tamped up to a level ½ in. above the base of the rails. As the concrete filling-in process nears completion, the portable forms shown in the illustration are arranged and the raised center portion brought up to form a foundation for the pavement between the gage blocks. These forms are built in sections, so that as one portion of the concrete bed sets the form shaping it can be moved ahead to the new work.

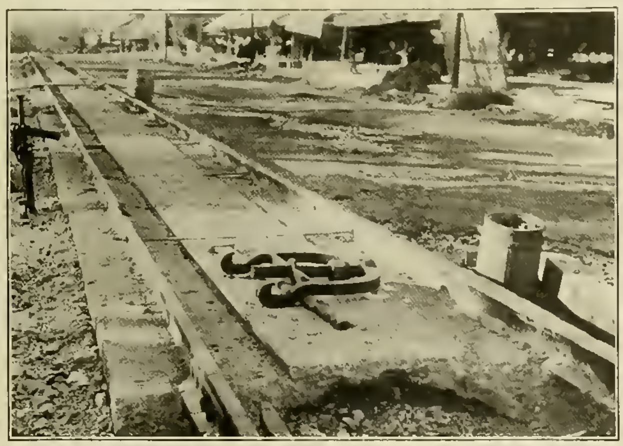


CROSS SECTION OF TRACK CONSTRUCTION WITH CONCRETE SUB-BASE.



CROSS SECTION OF TRACK CONSTRUCTION WITH STONE BALLAST.

Up to this stage of the construction splice bars are used to make the rail joints. When the concrete bed is being placed, space is left around the joints. When the bed has set, the fish plates are removed and the joints cast-welded by the Falk Co's. process. Each joint is made with a pouring of about 125 lb. of iron.



RAILS ON CONCRETE BED READY FOR ASPHALT PAVEMENT.

One of the illustrations shows the upper surface of the concrete bed broken away at the end of the special work. This is the finished surface ready for the pavement cushion of a 1 to 2½ mixture of cement and sand.

The track construction in the residence portion of the city is built with ties on stone ballast, conforming to the dimensions shown in the illustration. This type of roadbed is also used for special work in all parts of the city. The rails are of 6-in. T section, weighing 72 lb. to the yard, spiked to oak ties resting on a crushed stone bed and carrying a layer of concrete for supporting the granite blocks and pavement. The four Y's at the corners of the capitol square and the new turnout switches are made of T-rail and built-up Falk special work.

The overhead construction throughout the entire city has been rebuilt and a large portion of the old material replaced. The poles in the business portion of the city are of tubular steel set in concrete. These poles carry the ordinary type of span construction with one No. 0 trolley and Ohio Brass Co. fittings. Supplementary to the trolley wire are two No. 0000 weatherproof feeders, extending 2½ miles from the power house, the outlying portion of the line being fed with one No. 00 weatherproof feeder.

FINISHED TRACK ON CAPITOL SQUARE.

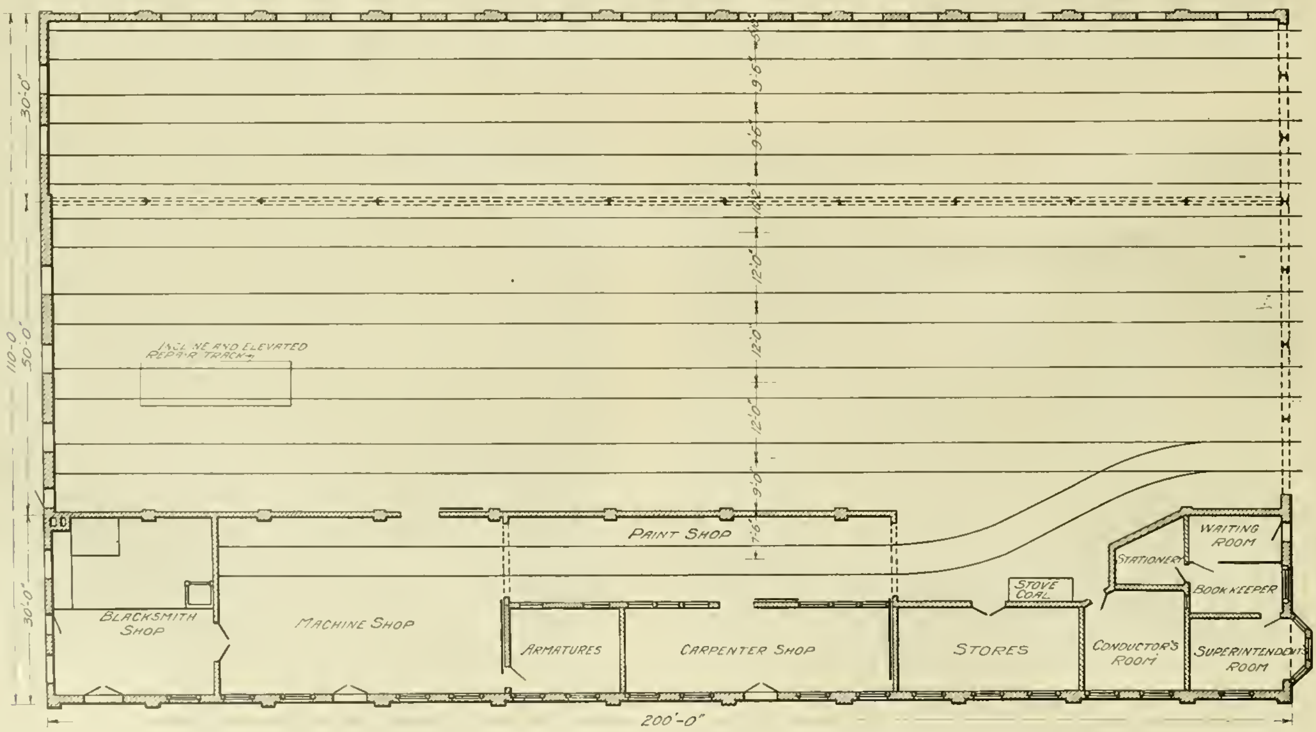
The return circuit through the rails is made complete at the joints in the 72-lb. rails by cast-welding, and also through the 60-lb. rails for 1¼ miles by cast-welding, the remaining portion being bonded at each joint with two No. 0000 solid terminal bonds.

Equipment.

In regular operation 11 cars are used to furnish a schedule with 10-minute headway. The rolling stock consists of 14 open, Amer-

ican Car Co's. 9 and 10-bench cars; two American Car Co's. 20-ft. body semi-convertible cars with Brill truck and two G. E. 52 or 54 motors. These cars are full vestibule and double-ended. There are also 14 double-vestibule closed cars, with 18-ft. bodies and G. E. 52 or 54 motors. The auxiliary equipment consists of a double-ended snow plow and scraper with closed body, manufactured in the company's shop, a combination sand car and snow plow, a substantially built tower wagon, a light repair wagon and the necessary construction wagons.

VIEW OF FRONT OF THE MADISON CAR HOUSE SHOWING STANDARD CLOSED CARS.



PLAN OF FAIR OAKS CAR HOUSE AND SHOPS.

New Car House and Shops.

The new building for the storage and repair of the equipment is located in the eastern part of the city, convenient to the Chicago & Northwestern Ry. tracks. The building, as illustrated, is of brick and steel construction, 200 ft. long by 110 ft. wide. One portion of the building, 30 ft. wide, is entirely set apart by brick fire walls and partitions. This section is equipped for the offices of the operating force and the general repairing of the rolling stock.

At the rear of the front offices is a conductor's room, connecting with the bookkeeper's office by a window. Next in the rear is a room set apart for stores for all departments. Adjacent to the storeroom is the carpenter shop, equipped with a planer, wood lathe, saws and a boring machine. It is interesting to note that this boring machine was made from an old drill-press frame that had been thrown aside. The frame was mounted on the carpenter shop wall and a new shaft inserted with bevel gears connecting with the old crank shaft, on which were mounted home-made wooden pulleys, so that the boring may now be done by engine power.

At the end of the carpenter shop is a room for armature work. One-half of this room is served by an overhead crane the carriage of which is made of old T rails with cast-iron wheels traveling over

a track of similar rail suspended from the roof. The movable carriage supports a chain block which by this arrangement is permitted to travel over the entire floor space. With this crane one man can handle armatures, lifting them to the repair horses and placing them in the bake oven.

Alongside the armature and carpenter rooms is a paint shop of sufficient length to accommodate two cars. This shop is lighted from above and by glass windows in the partition between it and the adjoining rooms. Cars are brought into the paint shop on a track having reverse curves around the office portion of the building. This track extends through the paint shop and into the machine shop, which latter room is 30 ft. wide by 40 ft. long. The machine shop is equipped with a drill press, lathes, shaper and the usual complement of smaller tools. In the center of this room is a post and jib crane, which can handle truck parts from the track space to the larger tools.

In one corner of the machine shop is a 12-h.p. gasoline engine having two driving pulleys; from the pulley on one side of the engine a belt drives the line shaft for operating all the tools in the different rooms, and on the opposite pulley, which has a friction clutch, is belted a 10-kw. 125-volt dynamo for lighting the buildings.

In the rear of the machine shop is a blacksmith shop and boiler room. The entire building is heated by steam generated in a steam heater set in a pit in one corner of the room.

That part of the building not occupied by the shops and offices contains seven storage and repair tracks, each 200-ft. long. The southernmost three of these tracks are built with 9 ft. 6-in. centers and used entirely for storage. The other four tracks in the center bay of the building have 12-ft. track centers and are used for inspection and repair work on the equipment in every day use. One of these tracks has a pit under it sufficiently long to accommodate two cars. At the rear of this building this same track runs up a steep incline onto an elevated repair track, shown in one of the illustrations. The center part of this track may be removed so that parts of the equipment can be let down to the floor by means of jacks.

At the rear of the car house and shop building are several smaller buildings, including a coal and salt storage house, 70 x 20 ft. in size, located convenient to a steam railroad siding; two storehouses, one 20 x 30 and one 30 x 40 ft. in size and a horse barn for the railway work teams and the storing of track tools. This barn is 50 x 100 ft. in floor area and two stories high.

INTERIOR OF FAIR OAKS CAR HOUSE, SHOWING ELEVATED REPAIR TRACK AT THE REAR.

Power for the operation of the road is purchased from the Madison Gas & Electric Co., at a fixed rate per car-day for regular cars. The charges for extra cars and trailers are based upon a rate per car-mile. The power house of the Madison Gas & Electric Co. is of especial interest, since the units are operated with gas engines using unpurified coal gas from the company's illuminating gas plant.

The general appearance of the interior of the new power station is shown in one of the illustrations. This building is centrally located, is fireproof, being built of pressed brick with a tile roof. The floors and wainscoting are white tile. The equipment used to furnish current for the railway operation includes the following sets: one 125-h. p. three-cylinder Westinghouse gas engine, direct belted to one G. E., 100-kw., 500-volt generator; one 280-h. p., three-cylinder Westinghouse gas engine, direct belted to one G. E., 150-kw., 550-volt, generator; one 280-h.p., three-cylinder, Westinghouse gas engine direct belted to one 200-kw., 550-volt Northern Electric Co. generator. In connection with this generating equipment is a 240-ampere hour storage battery which was furnished by the Electric Storage Battery Co. The output of this battery is regulated by a booster designed by the Northern Electric Co., of Madison, Wis.

VIEW OF THE ELEVATED REPAIR TRACK WITH CAR IN POSITION.

In addition to the gas engine-driven units the following equipment located at a second plant owned by the same company is at times utilized for furnishing railway power; one 50-h.p. Russel tandem-compound engine, operating condensing, direct-belted to two 100-kw. and one 62-kw. G. E. 550-volt generators. Steam for this engine is furnished by one of two 300-h.p. vertical Hazelton porcupine boilers.

Other than the reconstruction work which has been described, the Madison & Interurban Traction Co. is now making surveys and plans for the construction of an interurban road south from Madison to Stoughton, 17.25 miles. The officers of the Madison & Interurban Traction Co. are: F. W. Montgomery, president; Dudley Montgomery, vice-president; Warren Montgomery, secretary and treasurer; and G. H. Shaw, general superintendent. The Columbia Construction Co., Milwaukee, Wis., is engineer for the Madison & Interurban Traction Co. and its proposed extensions. This firm also designed the new car house and shop and built the new track work.

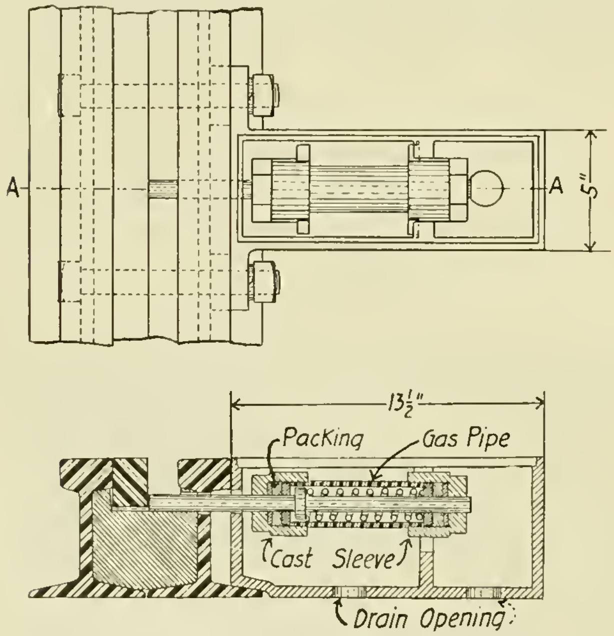
Throwing Devices for Tongue Switches.

BY T. A. GERLACH B. S., C. E.

Throwing devices for tongue switches are, as yet, a very much neglected part of the construction of special track work, and it is only within the last few years that the necessity of locking the tongue in facing switches has been generally recognized. The purpose of this article is to point out in a general way the various cases where throwing devices should be used and to describe and illustrate a few practical devices, giving some idea of how they should be constructed.

With the double-truck car and loose tongue it frequently happens that the tongue is thrown between trucks, causing derailment. This is especially noticeable where the switch has been more or less worn so that the tongue fits its bed imperfectly and allows the point to kick up as the wheel of the car leaves the heel, thus showing the necessity of locking facing switches.

Where the cars always take the same track, as in a diamond or side turnout switch, or where a single track branches into a double track, a single acting spring box should be used. Where the cars



FIGS. I AND 2.

are operated to the right the switch should be placed on the left hand side, so that in trailing through the tongue it does not have to carry the weight of the car while the tongue is forced against the spring.

Figs. No. 1 and 2 show an improved form of a single acting spring box which is designed for locations where the drainage is poor. It is of the push type of construction, but, having its spring enclosed in an oil chamber, its action can not be impaired by the presence of ice and mud. This oil chamber with its stuffing boxes may be made very simple in construction. The one illustrated consists of a piece of gas pipe each end of which screws into a malleable or brass sleeve, and each sleeve contains two washers between which the asbestos packing is confined. Fig. 1 shows how the oil chamber is held in the iron casing and how readily it may be removed whenever it becomes necessary to refill it with oil. The sleeve farthest from the tongue rests in the pocket of the casing and its lugs bear against the walls of this pocket, being held there by the force of the spring. The walls of the pocket have an enlargement near the top to prevent the sleeve from turning unless the box is forced slightly forward. To remove the box it is pushed slightly forward and turned through 90 degrees, which disengages the two lugs, allowing the box to slide back, and it may then be taken out. The cover in Figs. 1 and 2 has been omitted for the sake of clearness.

The cost of the device just described is comparatively small when made in large numbers, and it can be used with any height of rail.

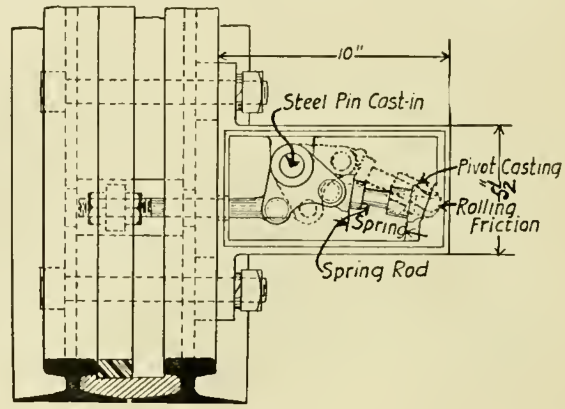
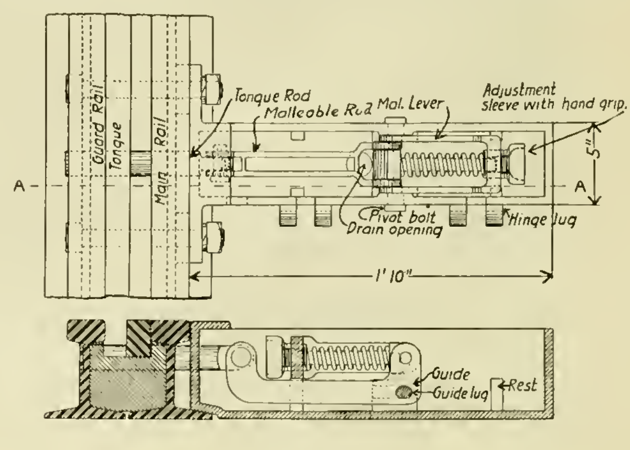


FIG. 3.

It is suggested that a traction company keep one or more boxes in stock, so that in case any of those in service should need repairing they may be replaced without delay to traffic.

In the case of a facing switch used about the same number of times in both directions, the lock should be of such a design that it may readily be thrown by the motorman. A few traction systems have introduced electrically operated devices for throwing the tongue and some of them give fairly good results. Within the last few years a great many of these electrical devices have been invented, but most of them are too complicated in construction to



FIGS. 4 AND 5.

meet with favor among street railway men. This objection applies also to devices operated by hand, most of them being unnecessarily complicated and bulky.

Fig. 3 shows a lock which allows the tongue to be thrown by the motorman's bar almost as easily as the ordinary loose tongue. This design is simple and compact and can be manufactured at a low cost. The bell crank is of malleable iron having a double jaw, one jaw connecting with the eye of the spring rod and the other with the eye of the tongue rod. The steel pin forming the pivot for the bell crank is cast into the box. The spring rod should preferably be of cast steel while the box and pivot sleeve may be made of gray iron. The two extreme positions of the mechanism are shown by full

lines and dotted lines, respectively. The spring rod slides in the pivot casting which sets in a recess cast into the side of the box, the spring holding the pivot casting in place.

A design recently made by the writer is illustrated in Figs. 4 and 5. This double acting spring lever throw bears the same relation to tongue switches that the ordinary spring stand does to split switches. The novel feature of this device lies in the fact that the spring throws with the lever and reverses its action when thrown, requiring only one spring, and a comparatively small box to hold the mechanism. Attention is called to the arrangement of the various parts. The enlarged portion of the spring rod is fastened to the connecting rod by means of a pin; the other end of the rod moving in an adjustment sleeve whenever the tongue is moved or while the lever is being thrown. The U-shaped lever is pivoted to the sides of the box as shown in Fig. 4. The tap hole in the lever which engages the adjustment sleeve is of sufficient diameter to allow the spring to pass through it, thus rendering it easy to replace the spring if broken. The box, hinge cover (not shown), connecting rod, lever, spring rod, and adjustment sleeve may be made of malleable iron.

This principle of the spring throwing with the lever as described has been applied to the design illustrated in Figs. 6 and 7, which may

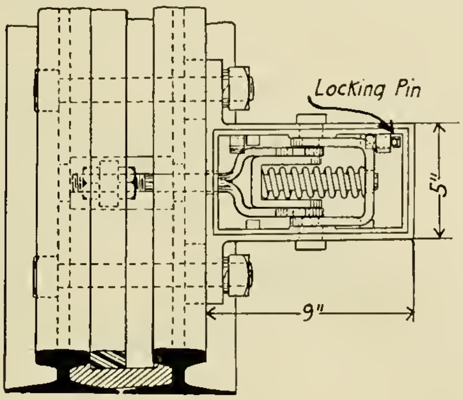


FIG. 6.

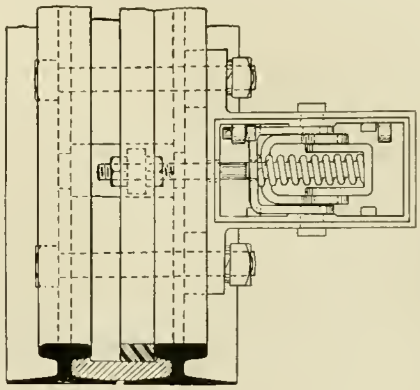


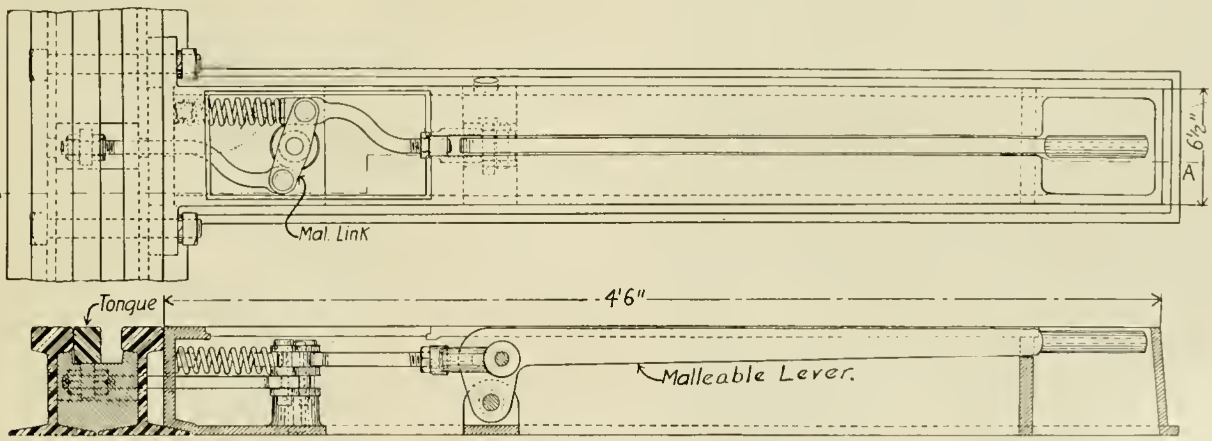
FIG. 7.

be designated as a double acting spring box and switch lock combined. Fig. 6 shows the tongue set for right hand and Fig. 7 for left hand operation of cars, assuming that the switch is right hand and that the box is placed adjacent to the traffic rail. The locking pin shown prevents the spring from revolving when the switch point is thrown slightly more than half way, and is to be used when the tongue is to be permanently set one way as in a spring switch. By removing the locking pin we have a switch lock and it then performs the same functions as the design presented in Fig. 3, but it has the advantage over such locking devices in that it has no dead center, that is, the tongue can not come to rest except in either of its extreme positions.

The center of the pivots of the spring receptacle and connecting rod is placed somewhat below the center of the lever pivots, and the lever rests are so arranged that the spring and lever throw slightly less than 180 degrees as is the case in the design shown in Fig. 5. The box is sufficiently small to be attached to the switch when shipped so that everything is connected up and ready for service before the switch leaves the shop. If the rail is less than 6 in. high and it is not desired to set the box below the top of the ties, the mechanism can be arranged to work in a horizontal instead of a vertical plane.

The advantage to the manufacturer as well as to the street railway company of such a combination spring switch and lock lies in the fact that only one kind of box is required for two distinct purposes. Furthermore the readiness with which the spring switch may be changed from one hand to the other is of great convenience to a traction system whenever it becomes necessary to suddenly change the direction of traffic.

There should be mentioned at least one other condition which occurs quite frequently in the operation of cars and to which none of the designs so far mentioned would be very applicable. In the case of a facing switch placed where one of the tracks is seldom used, the throwing device should be so arranged that the main line is always set for clear. This will save time and avoid accidents.



FIGS. 8 AND 9.

A motorman approaching such a switch does not use the same precaution as he does where the traffic is more equally divided, and for that reason accidents are liable to take place, especially where high speed is required.

An improved design to meet the condition just stated is shown in Figs. 8 and 9. The improvement lies in the fact that the same box and mechanism is used both for right hand and left hand switches and for right hand or left hand traffic systems, and also in the use of a spring and slotted lever, making it possible for the car from the siding to trail the switch without the free end of the lever kicking up. In facing the siding the conductor is obliged to raise the lever, holding it in a raised position until the car has passed, when he releases it and the switch is again set for the main line.

In making the same box do for either hand the construction will be somewhat more complicated than in a one-hand box, yet the difference in cost of the two types is insignificant. The construction of the box as shown consists of a malleable link pivoted by a steel pin cast into the box. This link has a double jaw at each end connecting with the lever rod and tongue rod. The arrangement as shown may be considered as being a right hand switch set for a right hand system. In a left hand switch and right hand system the tongue rod is connected to the opposite end of the link, assuming the position as shown by dotted lines.

In conclusion it may be said that within the scope of this article it is not possible to mention every condition of traffic where this or that throwing device could best be used. It may be said, however, that the aim should be in all cases to combine economy of time with the safe operation of cars. For this reason all switches in trailing should be so arranged that they need no attention on the part of the motorman. This feature has been observed in all the devices shown.

A Combination Freight Motor.

The electric locomotive of the Chicago, Harvard & Geneva Lake Railway Co., which is here illustrated, presents several interesting and practical features, being used for a variety of purposes. It is a combination freight motor and ballast car, and, on occasion, is also pressed into the passenger service.

The car is 32 ft. long and 8 ft. wide with cabs 8 ft. high. The frame is made in four 8-in. steel I-beams. The car was assembled in the company's own shops. It is fitted with No. 28 McGuire trucks.

The electrical equipment consists of four G. E. 57 motors with G. E. No. K-14 controllers. The wiring is placed in a wooden box about 8 x 12 in. in section, which fits in between two of the floor I-beams. This box has a removable cover so that the wires may be easily reached and repaired. The rheostats and air controllers are overhead in the cabs.

The National Electric Co's. air brake equipment is used, with automatic couplers of the mountain type, arranged to swing so that they will remain coupled on curves of short radii. The car is also furnished with hand brakes and sand boxes. The portion of the car body between the cabs is used for carrying ballast and is arranged

A NOVEL COMBINATION MOTOR CAR.

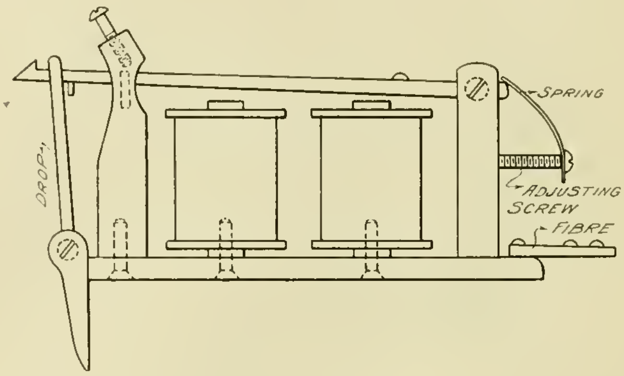
to side dump. The car has no roof, a running board about a foot wide carrying the two trolley stands. In summer, when the traffic is heavy, the motor is used as an open passenger car by putting in benches. The motor will haul a train of from four to six gondola cars loaded with crushed gravel and sand up a 3 per cent grade, negotiating this grade very easily.

The government of Ontario is considering the establishment of a railway commission to deal with the many questions affecting the electric railways of the province. It has had under consideration the question of the enlargement of the powers of the present railway committee of the executive council to include electric roads.

A Device for Locating Short Circuits on Feeders.

BY ARTHUR B. WEEKS.

An annoying thing in connection with a large power plant is a short circuit on its feeders, especially so if there is no way of determining which one of several feeders is affected. If it has been necessary to stop the generators, when they are again started and the feeder switch to the damaged line is closed, unless the operator at the station affected opens his switches as soon as the current is



ANNUNCIATOR FOR FEED LINES.

cut off at the main power house, a second shut-down at the power plant will be necessary.

When the short circuit exists between a distant station and the main power house, the result is self-evident. If the feeder is provided with an automatic oil switch, this switch is supposed to take care of such cases; but even these switches have their defects when loaded to their capacity, or on short circuit. Fuses and circuit-breakers have been depended upon to some extent, but since in high potential work the arc holds on and often totally destroys the panels and almost everything in sight, such fuses have in most cases been done away with, and the alternating-current circuit-breakers have been plugged shut.

In all of these cases it is necessary to break the fields of the alternators, either separately or by locating a solenoid in connection with each field circuit-breaker, having one switch operate them all. To wait until a report is sent in means a long delay and a great loss for all concerned, especially if contracts with tenants call for rebates during non-supply of current.

If the operator should by chance see the indicating instruments of the feeder affected, he would of course know which feeder switch to leave open when starting up again; but there are conditions under which even this is impossib'e.

The annunciator herewith illustrated has been in use in just such cases as are above cited, and on short circuit, the drop falls, at once indicating the feeder affected. These annunciators should be located in the place most convenient for operators' inspection; and if collected in a case by themselves, the drops can be lettered "Feeder No. 1," etc. They can be wired from a low potential circuit, as the wattmeter circuit, for example, one annunciator for each phase. A fuse should be in circuit with each annunciator, to prevent damage to its coils. Care should be taken that there are no loose connections in the fuse block or elsewhere, or there will be a constant chattering of the armature, and the fuse may blow from poor contact, and the drop fall. Of course where there have been no indications of a short circuit, the only thing to do is to replace the fuse and reset the annunciator.

The armature adjustment is made by means of the set screw so that the small current constantly passing will not upset the drop, and so that it will only drop when the current on the feeder is excessive, the arrangement being in shunt on the line. The accompanying cut is self-explanatory. The fiber is intended for the wire connections to the circuit. The flat spring which is used to keep the armature in its upper position need not be very stiff. Screws from below maintain the several posts in position.

If on trial the coils become too hot, coils having higher resistance will be required.

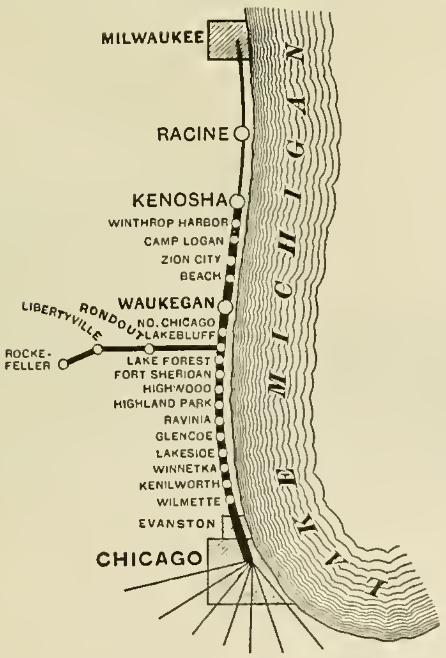
Extension and Improvements of the Chicago & Milwaukee Electric Railroad Co.

The reconstruction of the property of the Chicago & Milwaukee Electric Railroad Co. has progressed rapidly during the last year, and since the publication of a history of the extensions and improvements of the system in the "Street Railway Review" for December, 1904, many interesting developments have been made. One year ago the company had just completed its extension from Lake Bluff to Rondout, Libertyville and Rockefeller, the reconstruction and double-tracking of its entire line from Evanston to Waukegan, the installation of new power house and sub-station equipments, extensive park and pleasure resort additions and the perfection of some of its operating features.

The work completed since that time consists of building a new double track line from Waukegan to Kenosha, a distance of 21.24 miles, the erection of a sub-station south of Kenosha for feeding the new line, a very handsome passenger station at Zion City at the cost of approximately $25,000, a number of standard waiting stations on both the new and old lines, a handsome office building at Highwood, and the development of the freight and passenger traffic departments.

The work now under way and proposed includes the extension of the company's system from Kenosha to Milwaukee, Wis., the road bed and track construction now being advanced north from Kenosha; the erection of a large power station at Waukegan, which will supply power for operating the entire system; the erection of sub-stations at various points along the new line, and the purchase of additional equipment. The specifications call for the most modern type of interurban cars, 52 ft. over bumpers; 9 ft. over side sills; 37-in. seats, 26-in. aisles, seats spaced 34 in. center to center, and having a capacity for 56 people.

It is interesting to note in connection with the many improvements being made by this company that all work is being carried out under the direct supervision of the management of the company, track and overhead work is being constructed to standards



MAP SHOWING ROUTE FROM CHICAGO TO MILWAUKEE.

designed by the heads of the various departments, and the construction work being carried out by the company's own construction department, a complete outfit of locomotives, steam shovels, construction cars, etc., being owned by the company.

The most noticeable feature of the organization and development of this property is that it has been carried out along standard steam road practices and that it is a railroad in the strictest sense of the word and not an extended street car system. The entire line is constructed on private right of way and it is not burdened with the usual complications and conditions obtaining where the

ARTISTIC ENTRANCE TO NEW OFFICE BUILDING.

road is built on the highways. Thus operation is governed by the laws that apply to steam railroad properties, and now that the line serves Illinois and Wisconsin, the handling of its business is also subject to the laws and rules of the Interstate Commerce Commission. When completed to Milwaukee, which it is expected will be done before snow flies in the fall of 1906, it will be one of the best built electric railways in the country. The service which will be offered between Chicago and Milwaukee will compare favorably with that offered by its steam railroad competitors, the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul railroads, whose rates of fare are twice as much.

The officers of the Chicago & Milwaukee Electric Railroad Co. are: President, A. C. Frost; vice-president, H. S. Oakley; secretary and treasurer, Geo. M. Seward; general manager, A. L. Drum; chief engineer, F. J. Geraghty; superintendent, E. L. Des Jardins; superintendent transportation, J. P. Naumes; superintendent motive power, J. L. Matson; electrical engineer, C. R. Phenecie; superintendent overhead lines, J. F. Scott; superintendent construction, C. R. Frederick; traffic manager, C. W. Merrilies; general passenger agent, W. O. Kilman; auditor, A. A. Davison; claim agent, E. H. Vivian.

New Line, Waukegan to Kenosha.

The new line of the Chicago & Milwaukee Electric Railroad Co. from Waukegan, Ill., to Kenosha, Wis., was completed December 2nd, and an hourly service was then established which, since then, owing to the large traffic, has been increased to a 40-minute service.

This division, which really begins at Lake Bluff, west of the Chicago & Northwestern right of way, extends north to Kenosha, a distance of 22 miles. The road is built entirely on private right of way not less than 100 ft. wide, both in the open country and through the cities. A maximum of .4 of 1 per cent grade and of one degree of curvature are maintained with only three such curves in the 22 miles of double-track road. All culverts are heavy cast iron or concrete and all abutments are of concrete and built for four-

REAR VIEW OF OFFICE BUILDING—CHICAGO & MILWAUKEE ELECTRIC R. R.

track construction, as are also the culverts. The steel bridges are capable of carrying a loaded car of 100,000-lb. capacity.

The right of way of this road was very expensive for the reason that it is an air line, and the right of way being 100 ft. wide, it was necessary to purchase or condemn 38 buildings, some of them costing as much as $16,000. In addition to the right of way, the company owns valuable depot grounds and freight yards.

The equipment consists of 60 large double-truck interurban passenger cars, 4 locomotives, 20 freight cars; the freight business is at present handled by locomotives. The old line between Lake Bluff and Waukegan, east of the Chicago & Northwestern Ry. right of way, has been entirely reconstructed and at large expense placed on private right of way. All the new construction is built for a four-track road, two for local service and two for fast express service.

For the purpose of avoiding a grade crossing, the tracks of the Elgin, Joliet & Eastern Ry. at North Chicago were elevated 13 ft., and a subway built at this point. There are a large number of standard-type overhead crossings which consist of heavy plate girder bridges on concrete abutments.

The roadbed is of standard steam railroad proportions built on private right of way 100 ft. wide. The entire line is double tracked with 13-ft. centers, 80-lb. T-rail, A. S. C. E. section, laid on white oak ties 6 x 8 in. x 8 ft. in size, spaced 24 in. center to center. The track is bonded with flexible mesh rail bonds supplied by the Flexible Mesh Rail Bond Co., while all rail joints are of the "Continuous" type. All switches are equipped with standard No. 10 rigid frogs and high semaphore switch stands furnished by the Buda Foundry & Manufacturing Co. The track is well ballasted with gravel secured from the company's pit at Libertyville.

The overhead construction consists of 35 and 40-ft. poles supporting spans and carrying the telephone, direct-current feeder and high tension wires. The telephone line is carried on the 35-ft. poles and the others on the 40-ft. poles. The trolley wire, No. 000, is supported at a height of 22 ft. above the rails by a special hanger-ear designed by the superintendent of overhead lines of the company. The ears are designed to clinch the wire for a length of 12 in. and each ear weighs a little less than one and one-half pounds.

Sub-Stations.

The sub-station near Kenosha, serving the road between Waukegan and Kenosha, is known as the State Line sub-station, and will be equipped with three General Electric 500-kw. rotary converters and a 640-ampere hour capacity storage battery. At the present time two 500-kw. converters and a 320-ampere hour capacity storage battery are being installed.

The station is an intermediate sub-station and provision has been made to carry into and out of the station two 33,000-volt high tension transmission lines, 12 wires in all. These lines enter the station through a high tension tower, as shown on the plan, in which tower are located the lightning arresters, disconnecting switches and current transformers. This tower is air tight for the complete height of the building from basement to roof.

The connection from the transmission lines to the bus bars is made in this tower and the bus bars run in a high tension pit beneath the oil-cooled step-down transformers. The high and low tension leads from the oil-cooled transformers will be carried in brass pipe from the transformers to the high tension pit.

A switch track is led from the interior of the converter room to the main line of the road, so that in case of emergency a portable sub-station may be run into the station.

The special feature of the design was to make an ornamental sub-station with concealed wiring and at the same time use oil-cooled transformers with the high-tension bus bars located in the basement.

The storage battery plant furnished by the Electric Storage Battery Co. is equipped with the new type of carbon regulator. A 35-ft. span traveling crane of 10,000 lbs. capacity, built by the Whiting Foundry & Equipment Co., is located in the converter room, equipped to handle machinery the full length of this room

Zion City and Standard Stations.

The Chicago & Milwaukee Electric Railroad Co. is erecting at Zion City, the home of Dr. John Alexander Dowie and his followers, a very handsome station building, which will cost, when completed, $35,000. The plan and elevation of this new station are shown in accompanying illustrations. The building is located on the east side of and facing the company's tracks.

The station is divided into three general sections, the largest of which is 60 x 30 ft. in size and is used for the main waiting room. On the south of the waiting room is a wing, 18 x 20 ft. in size, half of which is used as a ladies' retiring and toilet room and the other half for the heating plant and coal storage room. On the north is a wing, 42 x 20 ft. in size, which is used for a baggage room, express office and men's toilet. The ticket office is located in the main waiting room in that portion of the building which forms the tower.

The building is of red paving brick, with window and door ledges of stone. The foundations are of concrete and all posts supporting the platforms and roofs of the platform shed are set on concrete piers. A covered platform 252 ft. long and 28 ft. wide extends along the tracks in front of the building. A platform of the same dimensions and style is placed on the opposite side of the track. A platform, 36 ft. long and 6 ft. wide, is placed at the entrance of

STANDARD PASSENGER STATION WITH PLATFORMS.

the building from a rear driveway. Ruberoid roofing is used for the platform roofs and red tile for the building roof.

A handsome brick fireplace will be built at each end of the waiting room. These will be 8 ft. wide by 8½ ft. high with an opening for the grates, 4 x 3 ft. in size. The building will be lighted with incandescent lamps and heated by steam, and when completed will compare favorably with the best standard steam railroad stations. The North Shore stations of the steam road which the Chicago & Milwaukee Electric R. R. parallels are very substantial and artistic and it is expected this new station at Zion City will be one of the most attractive along the route.

In 1903 a very handsome pressed brick station at Libertyville was built at a cost of $20,000. The Kenosha station shown is a standard type, but is only erected temporarily, as it is intended to erect a station similar to the Zion City station, but larger, next year. The station building proper is 24 ft. long and 12 ft. wide, and the platform is 72 ft. long by 18 ft. wide. These standard stations are constructed of Georgia pine and the interior finish is of natural wood. The buildings and platforms are well lighted and the more important stations are heated by electricity, "Consolidated" heaters being used. With the frequent service afforded it would hardly appear necessary to heat these stations, but nothing has been left undone by the company to provide every convenience for its patrons.

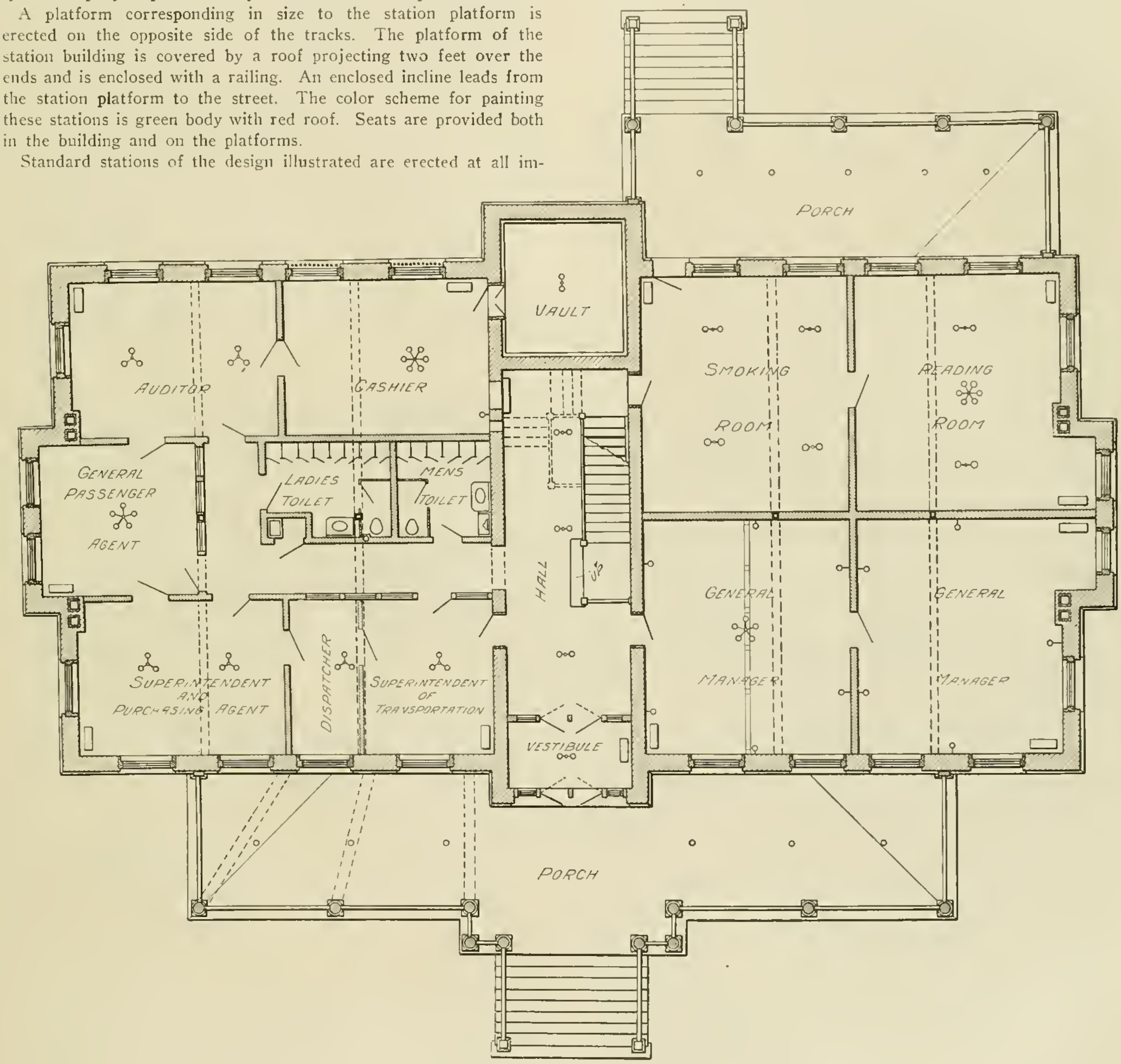
A platform corresponding in size to the station platform is erected on the opposite side of the tracks. The platform of the station building is covered by a roof projecting two feet over the ends and is enclosed with a railing. An enclosed incline leads from the station platform to the street. The color scheme for painting these stations is green body with red roof. Seats are provided both in the building and on the platforms.

Standard stations of the design illustrated are erected at all important stops along the entire line. There are in all between 30 and 40 of these stations, which are cleaned and swept each morning.

Office Building.

The new office building of the Chicago & Milwaukee Electric Railroad Co. is located a few hundred feet south of the power house and car barns at Highwood, Ill., and was completed and occupied about Sept. 1, 1905. The building is constructed of red paving brick with concrete foundation walls and gravel roof. The floors throughout the building are of hardwood, with the exception of the halls and toilet rooms, which are of mosaic tile. The walls in the various offices have a wainscot of burlap about five feet high with the upper portion and ceilings tinted. In the halls and in the employes' reading and recreation rooms the wainscot is natural wood. The woodwork throughout the building is of Flemish oak and the various furnishings of the rooms are of the same material, the harmony of the furniture and fittings being quite noticeable. The entire construction is of a slow burning character and ample fire protection has been provided by installing fire extinguishers about the halls and offices.

An accompanying illustration shows the floor plan for the first story of this new office building. The basement is given entirely to the use of employes, one half being used as a gymnasium and the other half for baths and locker rooms. The gymnasium is fitted with the most modern apparatus for physical culture, including chest exercisers, rowing machines, punching bags, parallel bars and jumping horses. Across the hall are located the toilet-rooms, in which have been placed two porcelain tubs and two shower baths, each being served by individual dressing rooms. Adjacent to the baths is located the trainmen's locker room. Here are installed 100 metal lockers furnished by the Chicago Builders Specialties Co. Motormen are given odd-numbered lockers, while the conductors have even numbers, the number of the employe determining the



FIRST FLOOR PLAN NEW OFFICE BUILDING, CHICAGO & MILWAUKEE ELECTRIC R. R.

number of his locker. The lockers are arranged against the walls and in two double rows in the center of the room. Portable oak benches are placed between the rows of lockers. At the foot of the stairs leading to the first floor a bootblacking stand is placed. The floors of these basement rooms are of concrete, a number of large mats being used in the gymnasium.

In connection with the gymnasium a portion of the grounds surrounding the office building has been set apart for the use of employes and equipped with a tennis court, trapeze, horizontal bar, jumping and vaulting bars, space for shot put, hammer throw, etc.

On the first floor of the new building are the offices of the general manager, superintendent, superintendent of transportation, general passenger agent and cashier, and additional employes' rooms. The office of the chief dispatcher is also located on this floor in the suite occupied by the superintendent of transportation. Dispatching is done by telephone, the company having its own system, with telephones installed in booths at the principal towns along the route. Train crews report at terminals and trains are run on schedule without orders as long as they are on time. When a train is late the crew reports to the chief dispatcher and orders are delivered over the telephone Motormen and conductors carry a supply of train order blanks, which are used when taking orders from the dispatcher. These blanks are filled in by the crews at the telephone booths, repeated to the dispatcher, and turned in with their daily reports at the end of the runs.

The train men's rooms on the first floor consist of a library and reading room and a smoking room. A generous number of tables and chairs, together with the library book cases make up the library furniture, and several tables, chairs and a large desk furnish the smoking room. The library consists of some five hundred volumes of standard works and fiction. These books are circulated among employes by the card system, the same as in any well regulated library. A librarian is in charge from 9 a. m. until 11:30 a. m., and from 1 p. m. to 4 p. m.. During these hours practically all reliefs of trainmen are made. A complete supply of stationary, including trainmen's reports, is provided at the desk in the smoking room, where a majority of the employes find it convenient to prepare their various reports. An assignment board is also located in the room. On this board the name of each motorman and conductor, printed on thin metal strips, is placed opposite the run each is to take. All the various rooms for employes were furnished and are maintained by the company without any expense to the employes.

A local ticket office is also maintained in connection with the general passenger agent's office. Well appointed locker and toilet rooms are also provided for the use of office employes on this floor.

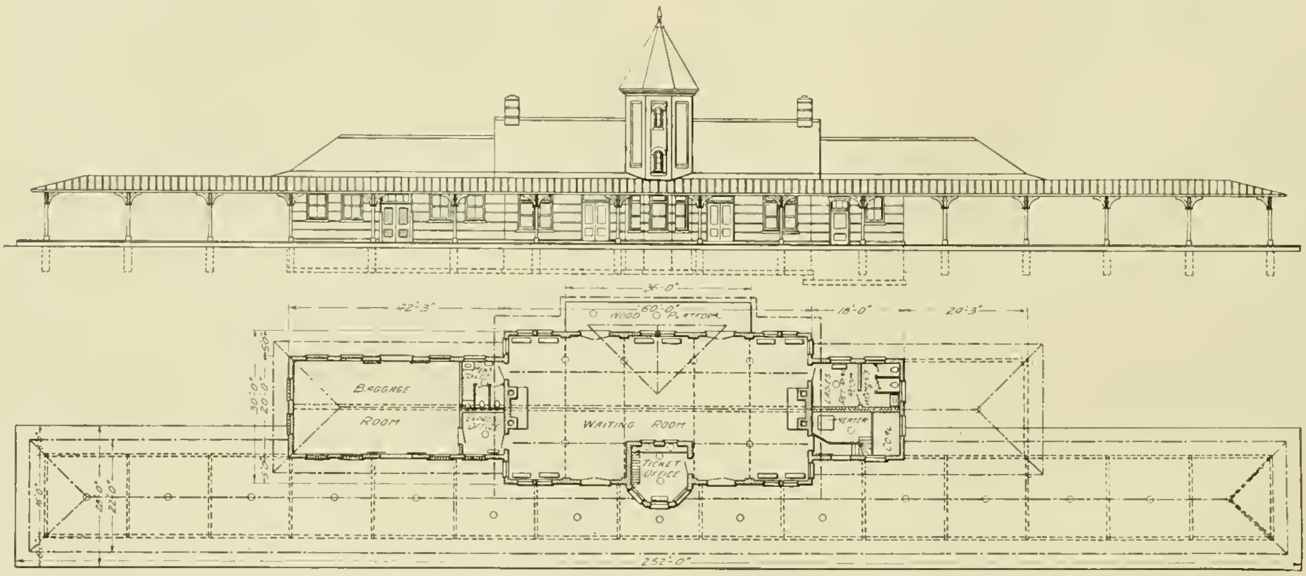
On the second floor are the offices of the general superintendent, the civil and electrical engineering departments, superintendent of motive power, superintendent of overhead lines, and the claim department. Commodious and separate drafting rooms are provided adjacent to the offices of the chief engineer and electrical engineer. The drafting rooms are well equipped, and are well lighted by large skylights and a large number of windows. A well appointed locker and toilet room is provided for use of the employes in the offices on this floor. The walls of the building which enclose the halls, the vault and the stairway on the lower floors extend upward, thus making a small third story. Here are located a dark room and blue printing room for the drafting departments. The fittings here include a large sink, tables, blue printing frames and a Dietzgen cylindrical blue printing machine.

A large vault, 10 ft. 4 in. x 11 ft. 6 in., extends from the basement to the roof. That portion of the wall of the vault included in the exterior wall of the building is 20 in. thick, while the other walls are 17 in. thick. The interior walls of the vault are lined with tile four inches thick. The basement vault is used for the storage of articles found on the cars; the first floor vault for the cashier, passenger and auditing departments; the second floor vault for the engineering department, and the third floor vault for the claim department.

In addition to "Babcock" fire extinguishers placed in the building, the company has a complete water system of its own that serves the group of buildings located at Highwood. A number of fire plugs are placed at suitable points, as are also supplies of hose. A fire alarm system has been installed in the various buildings and alarm boxes are placed at stations about the buildings and yards. An indicator located in the engine room of the power plant advises the engineer when an alarm is turned in, so that he can speed up the fire pump, which is in continual operation at a slow speed. A fire pressure of 124 lb. is attainable.

The buildings are also served by the local water works system. Steam for heating the building is obtained from the power plant, as is also the current for lighting the building. All wires, steam mains and water mains are carried to the building in underground concrete conduits.

The building is very complete and artistic in every detail and the harmony of decorations, woodwork and furniture is especially pleasing. The architect for the building was Fritz Foltz.



PLAN AND FRONT ELEVATION OF THE NEW STATION AT ZION CITY.

Freight and Express Service.

Freight and express traffic for the entire line is handled in the office of the traffic manager at Chicago, where all rates are made and where tariffs are published. A large portion of the express business is initiated by two suburban express companies, which have contracts with the large department stores of Chicago for delivering packages as far north as Waukegan. The express cars leave Evanston each morning at 3 o'clock and reach Waukegan about 6:30, so that purchases made in Chicago up to 5 o'clock in the afternoon are delivered at their destinations the following morning.

The express cars are only operated under a charter and the railway company is under no obligations with reference to delivery of shipments. The packages are tagged and billed by the various stores and an agent of the express company accompanies the cars on their trips over the line.

The regular express business of the railway company is handled in express cars that make four round trips per day over the entire line. The system of way billing employed for this service consists of a triplicate ticket issued at the time the charges are prepaid. The original is given to the consignor as a receipt for the shipment and for the charges. One copy is forwarded to the auditor for his file and the other copy accompanies the shipment as a way bill. It is a rule of the company that all charges for shipments must be prepaid.

The crews of the express cars consist of a motorman and conductor. The conductor acts as express agent for the company, except on the chartered cars operated by the suburban express companies, which are accompanied by the express company messengers. Although the shipments are carried to destination and placed on the company's platforms at consignee's risk, the express cars are operated on fixed schedules, and as most of the express business is regular the cars are met by consignees and shipments are taken by them direct from the cars.

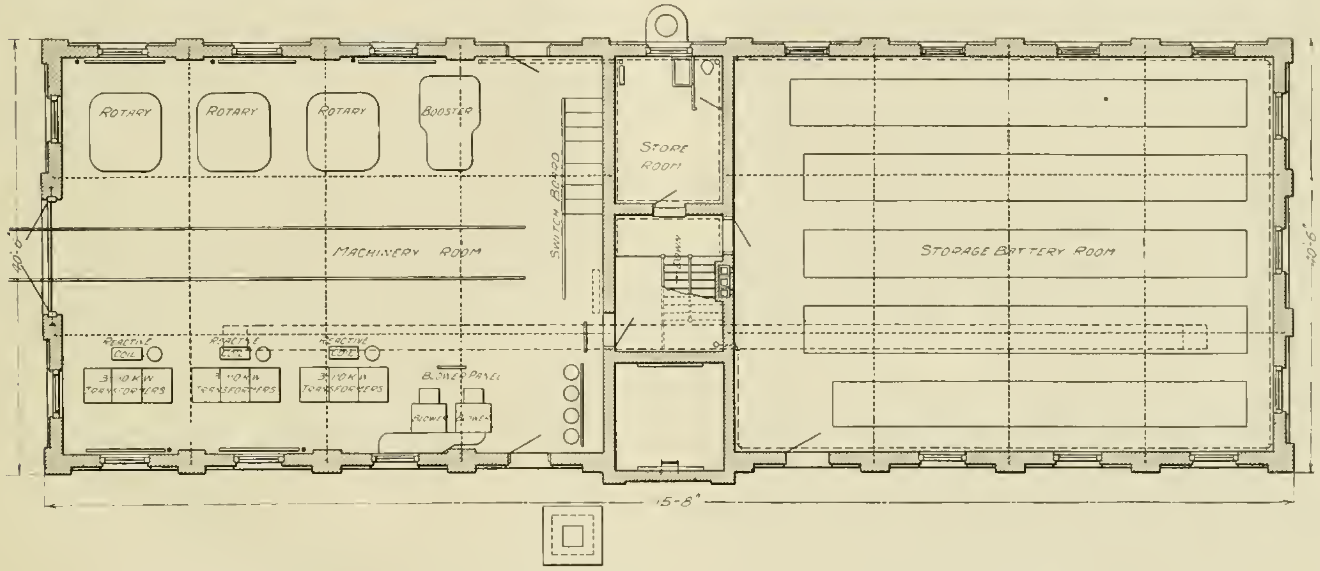
This express business keeps two 34-ft. express cars busy 12 hours per day. In addition to the service provided by these two express cars, passenger cars with baggage and express compartments are operated between Evanston and Waukegan, in both directions, at intervals of 1 hour and 20 minutes, while all trains on the Libertyville Division carry baggage and express. The trains carrying express are so indicated on the time tables published by the company.

Both freight and express tariffs are published by the company, the freight rates being based on tariffs published by competing steam lines and the express rates corresponding to those of competing express companies operating over steam railroads. Special commodity rates are published from time to time and general tariffs will be published by the company as soon as the size of the business justifies this measure. At the present time express rates are published, together with general rules regarding the handling of this business. Where special commodity rates are not published, all shipments in bags, baskets, cans, crates, etc., containing groceries, dry goods, produce, hardware and miscellaneous supplies, are carried at the following rates:

For packages weighing under 25 lb., 15 cents each.
For packages weighing 25 to 50 lb., 20 cents each.
For packages weighing 50 to 100 lb., 25 cents each.
For packages weighing over 100 lb., 25 cents per 100 lb.

The usual general rules regarding the railroad company's responsibility, prepayment of charges, delivery of shipments, etc., are included in this tariff.

The freight business of the company has not developed as rapidly as the express business, although two locomotives are employed in handling freight trains. Connections with steam railroads are made at various points on the line as follows: At Rondout with the Elgin, Joliet & Eastern; at Libertyville with the Chicago, Milwaukee & St. Paul; at Rockefeller with the Wisconsin Central; and at Zion City with the Chicago & Northwestern R. R. The freight business consists principally of shipments originating at industries on the electric line destined to points on connecting lines. One of the largest items is street material in the form of gravel which is had at a very large gravel pit owned by the company at Libertyville. A large number of the towns on the line are using this material for paving and the revenue derived from hauling it is quite large, 2½ cents per cwt. being charged for the haul from the pit to any point on the line. The Libertyville trotting track is located exclusively on the line of the Chicago & Milwaukee Electric R. R. and the tracks of the company serve the stables. At certain seasons of the year the company handles a large amount of stock to and from the race track, which is delivered to it by connecting steam lines at Rondout and Rockefeller. Other shipments handled by the freight trains include lumber, building material and rails. The freight train crews consist of engineer, fireman, conductor and one brakeman, whose duties correspond to those of men employed on steam roads. Freight rates at present are governed by the Illinois classification, although the opening of the line to Kenosha, Wis., will necessitate the use of the Western classification on interstate business.



FLOOR PLAN OF NEW SUB-STATION NEAR KENOSHA, SHOWING MACHINERY AND BATTERY ROOMS.

Industrial and Publicity.

The traffic department serves as the industrial department of the railway company for the purpose of locating new industries on its right of way. This department works in conjunction with the business men's associations of the different towns in securing factory sites for prospective manufacturers, giving more or less effort to securing industries of moderate size. The business men's associations prefer to develop their towns with small factories rather than large ones, because the trade and business of a town is not so much subject to fluctuation with the operation of a number of small factories as with the operation of one large industry.

All matters of publicity are also handled in the office of the traffic manager. During the summer advertisements are carried in the Chicago newspapers and in the local papers of the towns along the line. These advertisements include the attractions at Ravinia Park and Ft. Sheridan Park, together with a statement concerning the frequency of the service offered by the electric line and how to reach these parks from Chicago. Billboards are also used for advertising the attractions at the parks and metal sign boards two feet square are carried on each end of the company's cars. When these are not used by the company for Ravinia Park and Ft. Sheridan Park attractions, the company allows persons who have entertainments of public interest to use them without charge.

A number of very attractive time tables and folders are issued by this department from time to time. Such time tables and rates of fare for the summer season are published each year as soon as the season opens. For the season of 1905 this publication consisted of a 12-page folder, on one side of which were printed the time tables. On the reverse side were given the rates of fare, train service, special cars, and information regarding Ft. Sheridan, Ft. Sheridan Park and Ravinia Park, together with a small map of the road.

Form 17 2000-05

Chicago and Milwaukee Electric Railroad

WEEKLY REPORT OF TICKET SALES

This Report MUST be made for each Period ending the 7th, 14th, 21st and the last day of each month.

SINGLE TRIP TICKETS							ROUND TRIP TICKETS						
Destination	Form	Opening No.	Closing No.	No. Sold	Rate	Amount	Destination	Form	Opening No.	Closing No.	No. Sold	Rate	Amount
Total One Way to Summary							Total Round Trip to Summary						
COMMUTATION TICKETS							MILK EXPRESS and MISCELLANEOUS						
							Total to Summary						
							SUMMARY				Passengers		Amount
							Single Trip						
							Round Trip						
							Commutation						
							Milk						
							Express						
							Miscellaneous						
Total Commutation to Summary							Total for Period						

Report of all Tickets issued for Period ending ____________ 190__

Signature ____________ Agent

At ____________

AGENT'S REPORT OF TICKET SALES. ORIGINAL 8⅜ x 13¼ IN.

Several illustrations of scenes in the parks were also given. Another publication of the company, which is bound in an attractive cover, is entitled "A Day's Outing on the Chicago & Milwaukee Electric R. R." This pamphlet is also descriptive of Ft. Sheridan, Ft. Sheridan Park and Ravinia Park, and includes information regarding the golf clubs, hotels and cafes, educational, state and government institutions and lakes reached by the lines of the company.

The government Naval Training Station was located last year between Lake Bluff and North Chicago, on a beautiful tract of land between the electric tracks and Lake Michigan. Plans have been completed for the buildings, which contemplate an expenditure of approximately $2,000,000, and when completed it is expected that this will be the finest naval station in the country.

Passenger Traffic Department.

The traffic department of the Chicago & Milwaukee Electric R. R. was organized and has been developed along steam line practice. This department may be said to be divided into four sub-departments, as follows: Passenger traffic department, freight and express traffic department, advertising department and industrial department, all of which are handled under the supervision of the traffic manager. Of these sub-departments the passenger traffic is the largest and requires the attention of a general passenger agent, whose offices are located at Highwood, Ill. The general passenger agent is also auditor of passenger accounts and has charge of all passenger and express tickets, as well as tickets for the company's Ravinia Park theater.

Ticket agents for the company are located in each of the 22 towns served by the lines. These representatives are in many cases merchants whose places of business are near the company's stations. An agent is paid a commission upon the amount of business transacted at his office. It is required that each agent make out a ticket report at the middle and end of each month. The information included in these reports, as may be seen from the illustration, is similar to that found on the steam railroad reports. The station agents also sell tickets for the Ravinia Park theater and report the sale of park tickets in the same manner as the railway tickets are reported. There is no general admission fee to Ravinia Park when the special attraction is in the theater building, but when the entertainment is out-of-doors, such as a band concert, an entrance fee of 25 cents is charged.

Tickets.

The several types of tickets used on the Chicago & Milwaukee Electric R. R. are card tickets for single and round trips, blank destination coupon tickets, commutation tickets, and mileage coupon book as adopted by the several electric railways in Northern Illinois. In addition to these there are several special tickets, including a coupon book for school children, which is based on a rate of 3 cents for the usual 5-cent fare, and which is not good on Sundays or holidays or during the months of July and August. A special ticket is also used for the round trip to Ravinia Park and return, including admission. This is the usual card ticket with four coupons, consisting of the agent's stub, going and return portions and admission to the park. There is no reduction in the fare on this ticket and it is issued only for the convenience of patrons and to obviate congestion at the park entrance. A special ticket including dinner at the casino is also issued on such occasion as excursions of various organizations and special parties of large size. The latter ticket is similar to the preceding one except that it consists of five coupons. The five-coupon ticket is on sale only at the Chicago office of the company, where contracts are made for handling large parties.

The standard rates of fare are published in the many folders and pamphlets issued by the company. These rates appear in the form of a table.

The round trip and commutation rates are based on the single trip rates shown in the table and are as follows:

Where the Single Trip Rate is	Round Trip Good 10 Days	10-Ride Bearer Good 1 Year	25-Ride Bearer Good 1 Year	50-Ride Individual Good 60 Days
$0.10	$0.20	$0.90	$2.00	$3.00
.15	.25	1.20	2.50	4.00
.20	.35	1.70	3.50	5.00
.25	.40	1.90	4.50	6.50
.30	.50	2.40	5.50	7.50
.35	.60	2.80	6.50	8.75
.40	.70	3.25	7.50	10.00
.45	.80	3.50	8.50	11.25

No tickets are sold for rides amounting to less than 10 cents, but the fare is collected on the trains. During the summer special excursion tickets are sold at much lower rates than the regular round trip prices. The company is prepared to handle chartered cars or trains for clubs, societies and picnic parties, and special rates are made to suit such traffic.

The train service offered by the passenger department includes a 10-minute service on the southern end of the line between Evanston and Ft. Sheridan, 20-minute service in each direction between Evanston and Waukegan and 40-minute service between Evanston and Kenosha, Wis., stopping at intermediate points.

When there are entertainments at Ravinia Park, special trains are run to the park from both directions. These trains also leave the theater at the close of the entertainment. The schedule for the theater trains is printed on the backs of the entertainment programs and this schedule is maintained for all performances. The object of this service is to furnish convenient transportation for park patrons and to eliminate congestion on the regular cars.

FORM ... Form 19-1000-05

PRICE ... FROM ... TO ... MR ... AGT. AT ...

DATE	Invoice Number	DR. Opening Number	DR. Closing Number	Number of Tickets	Date Report	CR. Opening	CR. Closing	Number Issued	Bal. on Hand	Date Report	CR. Opening	CR. Closing	Number Issued	Bal. on Hand	Date Report	CR. Opening	CR. Closing	Number Issued	Bal. on Hand
										Brot For'd					*Brot For'd*				

TICKET RECORD KEPT WITH EACH STATION AGENT. ORIGINAL 8 x 5 IN.

December Meeting, Ohio Interurban Railway Association.

The Ohio Interurban Railway Association held its December meeting at the Chittenden Hotel, Columbus, Ohio, on December 28th. The meeting was attended by nearly 50 members of the association and men prominently interested in the welfare of electric railways. An executive session was held early in the morning. The regular meeting convened at 10:30 a. m., and the minutes of the November meeting were read and approved. President Spring then announced the subjects to be discussed during the day.

F. J. J. Sloat, of the Cincinnati, Dayton & Toledo Traction Co., chairman of the committee appointed at a previous meeting to suggest improvements in the interline tickets used by the various roads in the state, reviewed the discussion at Youngstown. He stated that he and the other members of the committee, Theodore Stebbins, of the Appleyard Syndicate, and J. H. Merrill, of the Western Ohio Railway Co., had previously suggested that the "closed-box" system, in which a receipt is issued in duplicate, be adopted, but upon further investigation they had decided that some other form was more desirable. In some cases where a large number of stations are reached on different roads radiating from one town the closed system would conflict with the local tickets and complicate the duties of the agents, conductors and auditors.

In view of these facts, and after continued careful investigation, it was the sense of the committee that the Strondberg multiple-ticket system be adopted as official by the association. This ticket is similar to the interline tickets now used by the steam roads, and bears the names of the principal stations on the various lines. In case the destination called for is not given on the form, space is left so the agent can supply the name of the town. On account of the importance of the question, it was unanimously agreed that the ticket question be discussed later in the day.

When the subject was again taken up in the afternoon a sample ticket was carefully considered and the report of the committee adopted. After some discussion a few changes in the original form were made, and the committee instructed to have samples printed and distributed to the members of the association. The suggested alterations included a time limit and the combining of the full and half fare tickets. This latter detail will be effected by printing a circle with a reader, "If half fare, punch here," thus eliminating one form.

The question of inaugurating the multiple-destination coupon ticket has long been under contemplation by the association. The ticket now used is in the skeleton form, and has been found, since the interchangeable agreement was made, to be very troublesome to make out and collect. By the use of the new form the routing of a passenger will take practically no time and the work of cancelling the ticket can be done by a single pressure of the conductor's punch. The principal arguments for this ticket were its simplicity and the ease with which it can be filled out.

The adoption of the multiple-station ticket does not, however, mean that the skeleton form will be abandoned entirely. Cases were cited where skeleton tickets were indispensable, and it was agreed that both forms should be official. The question will be discussed further at the January meeting and some definite action then taken.

President Spring next spoke of the arrangements which have been made for the annual meeting and banquet to be held at the Algonquin Hotel, Dayton, January 25. The programs prepared for this meeting and the banquet are to be of especial interest and value to traction men. It was announced that W. Caryl Ely, president of the American Street & Interurban Railway Association; H. H. Vreeland, president of the New York City Railway Co., and T. E. Mitten, president of the Chicago City Railway Co., have promised to address the members of the association. The consolidation of the Ohio and the Indiana associations will, it is expected, be perfected at the January meeting.

President Spring stated that after discussing the situation with the Indiana association it had been agreed that an alliance of the two associations is advisable. A committee, consisting of President E. C. Spring, F. D. Carpenter, Theodore Stebbins, J. R. Harrigan and J. L. Wilson, was appointed to confer with the Indiana association committee of the same number. The two committees will meet at an early date and perfect the arrangements for consolidation. If the plans of the committees are ratified, as is expected, the members of both organizations will unite at the Dayton banquet as one association.

The question of employing a permanent secretary will be discussed at the annual meeting. The duties have so increased that now, with but the affairs of a single association, the secretary must devote a large amount of time to association affairs.

Through Car Operation.

The discussion of the meeting was opened by Theodore Stebbins who suggested that some rules be adopted for the running of cars from one road over the tracks of another. Attorneys had advised that there is no law in Ohio forbidding such operation. He favored the adoption of some definite form of agreement, an agreement which all can depend upon. He also suggested that the association define whether or not it was the duty of the local company to furnish men for handling the visiting cars over the home lines. This question had been talked over, but on account of its importance was held over. At the suggestion of the president the matter was again held over.

In order that no trouble would hereafter be had with cars of one company passing over lines owned by another, C. W. Wilcoxon, of the Cleveland & South-Western Traction Co., recommended that clearance standards be established for the future construction of all cars.

Mr. Stebbins favored such action and suggested that all the details, such as flanges, treads, clearances on the right of way, etc., should be carefully considered. Instances were cited where visiting cars were hindered in their runs by obstructions which did not interfere with local operation. In planning for such standards it will be necessary to take into consideration the franchises of the various companies. It is known that in many cities the franchises are not too liberal, and it will hardly be possible to alter the track to conform to a given standard.

F. D. Carpenter proposed, on account of the importance of the question, that a committee be named whose duty it shall be to collect information from all the lines regarding their clearances and the maximum width of car which can pass freely over their tracks. Such information should be tabulated and distributed to the offices of all connecting roads. By this means every company can decide for itself whether or not its cars can pass over another line without trouble, and if not, can make necessary changes in accordance with the standards of such roads.

After further discussion the question was referred to the subject committee with instructions to report at a later session.

Advertising—The Proper Method.

A. L. Neereamer, traffic manager of the Columbus, Delaware & Marion Ry., opened the discussion on electric railway advertisements. He said that in his opinion a road can not do too much judicious advertising. The daily newspapers furnish the best way for reaching the public. He stated that short readers in the "local" columns always had brought his road the best results. In getting up special advertisements he advised against cheap work, as such advertisements are thrown aside and forgotten. Good, substantial buttons or calendars bring good results, and attractive time cards, posted conspicuously at crossings along the line, are beneficial. When advertising a summer attraction the use of billboards is one of the best ways of attracting the attention of the public. Much care should be taken in placing the boards at popular street corners and the boards should be kept in good condition.

F. J. J. Sloat said that attractive posters bring good results.

A. W. Anderson believed that most any kind of advertising brought results if the company would advertise only those attractions that it actually has.

F. D. Carpenter stated the people are not yet aware they can ride long distances on electric lines. He suggested that electric

companies follow the plans of advertising adopted by the steam roads. This suggestion was favored by Mr. Sloat, who remarked that a large per cent of travel for distances less than 200 miles should be by the electric lines. More frequent exchange of time tables would afford better advertising for all parties concerned.

Mr. Stebbins stated that every road should have prints and maps of every other road posted conspicuously.

J. O. Wilson said that the Cleveland & South-Western Traction Co. has had better results from folders than from any other kind of advertising. Along this road folder racks are placed in all stations, so that the patrons can help themselves. Many of the folders are destroyed, but the majority of them are used to the advantage of the company.

C. M. Paxton, traffic manager of the Dayton & Troy Electric Ry., stated that every paper in Dayton carried a display advertisement for his company, and these bring good results. In return for the advertisements the company carries the papers for the publishing companies and furnishes them with transportation. Mr. Paxton does not believe this method of advertising helps to increase the freight traffic.

Secretary Coen stated that he believed the most satisfactory method of doing local advertising is to keep the cars and stations clean and comfortable and provide good service for the public.

President Spring said all advertisements should be plain and simple, so that the average man can comprehend them. Also that good service and clean, comfortable properties are the best advertisers. Bulletin boards showing maps of roads with which interchange is made are good advertisements.

Shop Records.

J. C. Gillette, master mechanic of the Columbus, Delaware & Marion Ry., opened the discussion on shop records. His company uses the card system, but does not keep a detailed report of work done on each job. By use of the card system, however, the cost may be obtained from the material, supply and time reports. Each workman makes out a slip stating the amount of work done each day, and the shop foreman makes a daily report of material used. When a car is turned in for repairs a 3 x 5-in. blank car report is signed in duplicate by the motorman and conductor, one of which reports passes through the hands of the barn foreman to the office. When a complete overhauling is found necessary, the foreman fills out a duplicate report and sends the original to the head office.

From the train sheet of this road the mileage of each car is figured up at the end of each month. When the trucks are shifted from one body to another the daily slips show the date of change. Accurate account is kept and no trouble is had in determining the mileages. By this method it is not necessary to keep a big set of books, thereby saving the wages of one man. His company keeps the daily detailed report of material used, and at the end of each month the average wear and tear on wheels, trolley wheels, consumption of oil, etc., per 1,000 miles is recorded He stated that while this system was, perhaps, not as effective in detail as some others used, he could easily determine the average cost of each piece of a car. The cost of brake shoes on this line varies from 50 cents to 90 cents per 1,000 miles.

A. M. Frazee, of the Columbus, Buckeye Lake & Newark Traction Co. followed in the discussion. His company maintains the standard street railway classification and enters all special work done on a car against that car. By this method the mileage of every part of the car, the wheels, axles, journals, journal bearings, etc., are carefully recorded. At the end of each month the car mileage is totaled.

L. C. Bradley, of the Scioto Valley Traction Co., said that he believed the main reason for keeping records is to get at the cost of maintenance. His company carries accounts of 25 different parts of the cars. If a car is damaged by accident, the cost is charged to casualty and not to maintenance, as most roads do. Cars of one class are carried under one head and in a general wav the average cost per 1,000 miles is kept.

C. W. Wilcoxon stated that he believes in complete shop records. In the case of a small road operating only a few cars the 1,000-mile basis may bring too small results to be of value. In order that a large road may be able to compute its accounts accurately the shop records should be carefully kept. Mr. Wilcoxon favors the card system because of its simplicity. A novel way for keeping trolley wheel records is to put a slip of paper bearing the date and hour the wheel is put into commission, into the base of the trolley pole, and when the wheel is worn out file the slip for future reference.

Transportation—Employes and Their Dependents.

Mr. Stebbins outlined the methods used by the Appleyard Syndicate in issuing transportation to its employes and their dependents. After a careful study of the question, he had found that from 15,000 to 18,000 passes, aggregating from 110,000 to 125,000 miles, are used each month on the six different properties in his charge. With the method in use he is able to ascertain who is doing the riding and where it is being done. Passes in blank form are issued, and before being used they must be signed by the employe in the presence of the conductor, who punches the stations between which the pass is used. The passes are issued to the different departments in serial form, so that by checking up at the end of each month the exact distance each department has traveled is easily computed. As each pass is turned into the office it is checked up in a manner similar to other tickets. So accurate is this system it is possible to tell how many miles and between which stations each employe travels.

Mr. Stebbins stated that his company is liberal with families of employes. The passes are issued to the superintendent, who distributes them in turn to the foremen. The latter issue them to the employes as they are needed. These passes cost the company 35 cents per thousand and are found to be cheaper than the perpetual card pasess.

Mr. Coen stated that the Lake Shore Electric Ry. issues passes in books of 50 tickets each, which expire with the year. On the back of each ticket is printed a list of towns through which the road passes. These books are dated and one is issued to each employe. By keeping a complete record of the passes it is readily ascertained if they are abused. The company is also liberal with its employes' families, and thus maintains the good will and friendship of all concerned. Trip passes for members of the employes' families are furnished upon request.

C. W. Wilcoxon said that a company loses nothing by being liberal in the matter of furnishing passes to employes and their dependents. The Cleveland & South-Western Traction Co. issues to employes a book of passes sufficient for rides to and from work for one month. These are sent to the heads of each department with the names of each employe written on the books. The tickets are punched between the limits of the employe's work and his home. Each foreman carries an extra book to use in case of an emergency. The company also gives the head of each department authority to issue trip passes to an employe's wife as often as requested.

A. W. Anderson, of the Dayton & Xenia Transit Co., said that employes are frequently asked to do work not especially in their line, so in return we feel it our duty to be liberal with them and their families. Our pass system resembles the systems described by Messrs. Coen and Carpenter. The trip pass books are renewed as often as they are used up. Every man gives up a ticket whenever he rides, and these are carefully checked up. When an employe's wife, father or mother wishes to ride on the line, we issue a trip pass. By this method we have obtained a set of loyal men who work for our interest.

George Whysall said that the Columbus, Delaware & Marion Ry. refuses passes over its lines only on Sundays and holidays. Beginning January 1st a book of trip passes will be issued monthly to every employe.

Other matters of interest were discussed and the following were voted to membership in the association: John S. Sawyer, National Electric Co.; J. Chas. Ross, general manager Steubenville Traction & Light Co.; E. J. Davis, Columbus, Buckeye Lake & Newark Traction Co.; Geo. Whysall, general manager, Columbus, Delaware & Marion Railway Co.; A. W. Jordan, passenger agent, Columbus, London & Springfield Railway Co.

A. W. Anderson was appointed treasurer of the association to succeed R. E. De Weese, who, on account of ill-health, is unable to attend to the duties of that office.

The meeting then adjourned until January 25th, when the banquet will be held at Dayton.

The postoffice department at Washington will install a street railway mail service between Stillwater and South Stillwater, Minn. There will be three mails each way daily, with one mail on Sunday.

December Meeting, New England Street Railway Club.

The December meeting of the New England Street Railway Club was held December 28th at the American House, Boston. The speaker was H. W. Young, of the Boston office of the Westinghouse Electric & Manufacturing Co. His subject was "Lightning Protection." An abstract of Mr. Young's address follows:

In planning the installation of lightning protective apparatus for railway systems the plans should not be decided upon until the location of stations, lines and apparatus has been definitely determined. It is a most serious mistake to complete plans for power stations without any regard for protective apparatus, for this equipment requires space for insulation, ventilation and accessibility. The location of lightning arresters should be such as to provide each separate line leaving the building with one arrester having a voltage rating slightly exceeding the voltage existing between line and ground when one of the wires of the system is grounded. This excess rating may in some instances vary from 25 to 100 per cent greater than normal. Relatively heavy insulators should be used in cases where heavy thunderstorms and strong winds are frequent. If high voltage generators supply the line directly, without stationary transformers, still greater care becomes necessary in the choice of arresters. Since the value of protection afforded in any case is directly proportional to the difference in resistance to static charges offered by the protective device and the apparatus it is intended to shield, preference should be given to those devices offering the lowest equivalent spark gaps. These spark gaps should be considerably lower in value than the impedance of the protected apparatus. The lowest equivalent air gap is that gap in inches which, when placed in multiple with the arrester, will just fail to take the discharge.

A choke coil impedes the free passage of static discharges, but a lightning arrester should offer a very free path. In the absence of suitable arresters on a railway line, the static discharge is liable to all pass through a motor armature, probably puncturing it near the point of entry of the static into the coil, and often followed by a line current capable of seriously injuring the armature. The insulation of old apparatus is much more difficult to protect intelligently by arresters than that of new equipment, for there tends to come a time when the insulation is so poor that it affords a freer discharge path than the protective devices themselves. The ideal lightning arrester would require an equivalent spark gap of zero, allowing a static discharge to pass through it with absolutely no opposition. While this condition is not to be obtained in any commercial arrester, the advances in design tend toward a point where the freedom of discharge may be reasonably satisfactory.

The multigap arrester with series resistance pencils depends for its action upon the ability of the resistance pencils to suppress any short circuit current which may follow a static discharge. A second type is the multigap with non-arcing metal cylinders arranged on the "low equivalent" principle. This type has the lowest equivalent spark gap of any arrester for the service for which it is designed, and an instantaneous current carrying capacity which, while not affecting the normal operation of the system, materially aids in clearing the line of disturbances. It is specially effective in effacing surges due to grounding, short circuits, etc. The discharge also takes place too quickly to open the circuit breakers on systems where they are tightly set. The low equivalent arrester element consists of a number of small series air gaps connected to the line, having a certain number shunted by resistance. A second non-inductive resistance is placed in series at the lower end and the entire element connected between line and ground. In case a lightning discharge passes the series gaps, it meets opposition in the shunted resistance and jumps the shunted gaps, passing freely to earth through the non-inductive series resistance. The arc tending to follow the discharge is then withdrawn from the shunted gaps by the shunt resistance. Once out of the shunted gaps the current must pass through the shunted resistance, and this so reduces the current that the series gaps and the resistance can both readily suppress the arc. The single-pole type is used with the higher voltage. In the event of a hold-over with the low equivalent type of arrester, the only failure would be in the fusing of the resistance, which immediately opens the circuit.

The horn type of arrester requires some additional resistance to cut down the flow of current on short circuits in order to preserve its life; even then its action is so slow as to impair its usefulness in railway work, and for indoor service it is a very undesirable type. The resistances so far used with this type have proved to be of very doubtful value.

It is generally agreed that choke coil protection is necessary in every progressive installation. Either the static interrupter or the simple choke coil may be used in high voltage work. The former is applicable only on the terminals of apparatus between the switches and the equipment protected; the latter may be placed directly in the line leads or in the terminal leads. The placing of coils in the line leads does not allow as economical an expansion of the station or as good protection against switching strains as when the coils are placed in the leads of the apparatus. The static interrupter differs from the choke coil in the addition of a condenser between the coil and the apparatus protected. The condenser has the effect of increasing the speed of a high frequency discharge's entrance into the choke coil, with the result that the coil chokes back even more violently on account of the increase in its effective impedance.

It is very important, however, to protect impedance coils against side flashes, extending the insulation between layers far enough beyond the wire to form strong barriers. The same construction is used with oil immersed choke coils.

Considering low tension protection against lightning, as in feeders, trolley circuits and cars: Arresters should be located so as to protect the cars rather than the feeders. Experience shows that 5 or 6 arresters per mile will usually be satisfactory. Every car should also be equipped, even though the line may be, because any apparatus connected to the line shares with the arresters in clearing the line. The forms most generally used are the moving plunger type, the magnetic blow out, and the fixed coherer type.

An effective form of arrester for 500-volt station series consists of a set of choke coils connected to carbon electrodes immersed in a tank of water. This provides a good path to earth, although it is the cause of considerable line leakage.

Mr. Young exhibited slides of special test papers through which discharges had passed, and discussed at some length the methods employed to obtain paper records of arrester performance in actual service. Original test papers of this kind, which had been punctured under various conditions, were brought to the meeting for the inspection of the members.

Many inherent failures heretofore ascribed to defective protection have now been almost eliminated. Although much has been done, we are still ignorant of the quantitative measure of the forces to be dealt with. This knowledge can be obtained in large measure by the co-operation of operating companies at large. On many railway systems of the first importance we find lightning arresters of the most antique design. In many cases leads are burned off or grounds poorly made; bad rail bonding frequently occurs, and this where the rails provide the only path of discharge to the earth. No regard is given to the system as a whole and the question of lightning protection is given a haphazard and indifferent attention which does the operator no good and throws most unjust criticism on the manufacturer of protective apparatus. Of all disturbances to a system, that from lightning is doubtless the most unwelcome. It is not present the whole time and varies greatly in intensity from storm to storm. Considering the exceedingly moderate cost of protection, it is singular that so little is done. Every railway should place the matter of lightning protection in the hands of a special man, preferably a technical graduate with some experience with one of the larger electric companies. His sole duty should be to map out the system, locate arresters, see that they are in first-class condition, make good grounds, use tell-tale boxes to record their operation, etc. He should report to the manager after each storm as to the damage done to apparatus, approximate loss of revenue, remedies applied, etc. A profit and loss sheet on this score would show some surprising results. Considering the losses entailed by armature breakdowns and repairs, the disabling of cars and derangement of schedules, the initial and maintenance cost of a proper lightning equipment would soon be fully warranted by the decreased repair bills, increased revenue and better service.

A trackless trolley is being constructed by the citizens of Melrose, Mass., to connect that city with the line of the Boston Elevated Railway Co.

THE
STREET RAILWAY
REVIEW
AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE
KENFIELD PUBLISHING CO.,
45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:
New York—39 Cortlandt Street. Cleveland—302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:
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New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

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This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XVI JANUARY 15, 1906 No. 1

CONTENTS OF THIS NUMBER.

ANNUAL INDEX.

Accompanying the January number of the "Review" is the annual index for the past year. These pages should not be overlooked when binding the 1905 volume.

THE CENTRAL ELECTRIC RAILWAY ASSOCIATION.

One year ago we announced the first meeting of the Indiana Electric Railway Association, and if the plans now formulated do not miscarry the January, 1906, meeting which is reported in full in this number of the "Review," will have been the last session of this society as a separate organization. The Ohio Interurban Railway Association, which has also done a vast amount of good, will hold its last meeting in the near future. From then the work of the two associations will be united and increased efforts for advancement made under the new name, Central Electric Railway Association. The personnel of the new association and the individual records of its component societies are sufficient recommendation for the future success of this unified organization of railway operators.

HELPING THE CITY GROW.

So little credit is ever given a railway property for the part it plays in expanding the limits of a growing city, that we are pleased to reprint the good words recently spoken by "Finance" in describing the growth of Cleveland:

"If one were to write the history of the Cleveland Electric he would find upon reviewing his work that he had written the history of Cleveland. Wherever the railroad company has extended its tracks, wherever it has made improvements, there has Cleveland grown and expanded. The great expansion of Cleveland—the fact that thousands of our people live in the suburbs, has been made possible by the trolley. There is no denying these facts, and while it is popular to denounce public service corporations, there is no gainsaying the fact that nine-tenths of the talk against the Cleveland Electric is unfair. As a matter of fact, the Cleveland Electric is more fairly conducted in so far as the public is concerned, than are nine-tenths of the various other enterprises of Cleveland.

"It has given them warm, well ventilated cars in the winter time and airy open cars in the summer time. It has given just as good service as it is possible to give under present conditions. It has extended its lines before there were enough people living along the extensions to make the extensions profitable. It has done this both for Cleveland and for itself, for when Cleveland prospers, so prospers the Cleveland Electric, and it is the height of folly to think that this one corporation, that this one crowd of men, should be picked out as a target for politicians; that it should be singled out as the only business concern in Cleveland which should not share in the growth and prosperity of the city.

"Do the people of Cleveland realize that their street-car fare is the only item of expense they have, which has been reduced in the last ten years? You can not buy as much meat for five cents today as you could ten years ago by 50 per cent, and you can not buy as much of anything for five cents as you could ten years ago by 50 per cent, except in a street-car ride. In Cleveland to-day for five cents you can buy three times the amount of ride that you could ten years ago for the same money. And yet the railroad company is picked out as a subject to stir up the people against.

"Some day, however, the people will change their mind. They will learn to appreciate the fact that the history of Cleveland is the history of the Cleveland Electric and they will learn that their own prosperity depends upon the prosperity of the Cleveland Electric."

ALWAYS ON TIME.

To hold patronage in any business the organization with something to sell must be reliable. This statement holds for electric railroads as well as it does for any store or manufacturing establishment. If we have transportation facilities to sell and want crowded cars one essential "talking point" for the road must be that its cars are "always on time." Patrons soon learn that if they want to catch the ten o'clock car they will not have to stand on the corner until ten-fifteen before it comes along and, once learning of the reliability of the schedules, will soon boost the road. Few things make a man more out of patience than to keep an appointment and find the other party late.

As a rule interurban lines operate under much more severe schedule-maintaining conditions that their steam competitors. The interurban has no regularly scheduled stops, but must take on and let off passengers at road crossings and at other points where it is thought necessary to place stations. Unnecessary stops are frequent and obstructions to traffic more liable to occur than on steam roads. Also the distances between stopping points are less. Nevertheless, as a result of the commendable practice of many roads in keeping a record of the percentage of trains on time it has been shown in many instances that if proper schedules are used and conscientious effort made to maintain them, electric trains can show a percentage of trains on time equal to those of steam railroads.

Illustrating this is the annual report of the West Penn Railways, which shows that during the year of 1905, 97.2 per cent of the cars starting from the Connellsville and Uniontown terminals arrived and departed on time. When we consider the many causes which make for delay in the schedules of this interurban road, this record is more or less remarkable.

The territory served lies for the most part, among the foothills of the Allegheny mountains. Grades running as high as 12 per cent are encountered. The nature of the territory served necessitates frequent curves, the amount of tangent between them being in no case very great. The country is very populous and the line passes through a number of small towns, which calls for frequent stops. Also there are several steam road crossings and a number of bridges and viaducts. Owing to the hilly nature of the country, wash-outs and landslides are not infrequent.

In the matter of computing the figures given, all cars that do not run more than five minutes behind schedule are considered on time. A train register is kept at division points and shows the arrival and departure of all cars, names of crews and condition of track. From these registers, a report is compiled every 15 days, showing the proportion of cars on time. It is also of interest to note in comparison with an earlier year that the report for the year 1904 showed the remarkable high schedule observance of 97.1 per cent, from which the showing for the year just past varies but slightly.

THE ELECTRIC RAILWAY IN 1906.

The beginning of a new year is an event of importance in all industries. The widespread custom of attempting to forecast the coming twelve months in the light of the departing year's experience may well be followed in the great industry of electric railroading. For there is not the slightest doubt today but that the transportation of passengers by electricity is one of the typical great industries of the twentieth century, and we believe that this should be the mental concept of every worker in the field in 1906, from the track greaser to the railroad president.

All about us signs are apparent that the general public is growing more and more to realize its dependence upon electrical transportation, and there is little doubt but that the day is near when our faithful friend, the steam locomotive, will be withdrawn from active service in all of the larger urban communities. The magnitude of the terminal improvements at New York is widely realized, but few persons appreciate as yet the revolution which the Pennsylvania and the New York Central developments will bring about in the methods of handling suburban and terminal passenger traffic. We are all familiar with the disturbed schedules, slow acceleration, smoke, dirt, cinders and general inflexibility of the steam operation of heavy suburban service. The inauguration of electric service at the metropolis is certain to create an irresistible demand on the part of the public for improved facilities elsewhere, and this means nothing else but the beginning of the end as far as the steam locomotive is concerned. It is greatly to be hoped that the operation of the electric trains of the New York Central will commence in 1906 as planned, for the time is certainly ripe for electric railway developments on a grander scale than ever before.

The experiences of 1905 will not have been in vain if they stir electric railway managers to more vigorous warfare against the fallacies of municipal ownership. The past year has witnessed tremendous political upheavals and we believe there is a stronger pressure upon municipal office holders making for honest administration than at any previous time in recent years. But even if graft in all its forms could be rooted out of American public life, the wisdom and economy of municipal ownership would still be unproved in reference to American conditions. The enormous amount of foolish legislation which has to be defeated each year by the great street railway systems of our larger cities is evidence enough that the business of carrying passengers in electric cars is better off in private hands, though a reasonable degree of state supervision may be justified. The street railway manager who did not realize that the interests of his company coincide in large measure with the interests of the public could hardly hold his position a single year. Some of the more progressive managers have lately formed the commendable habit of taking the thinking public into their confidence by delivering wise and far-sighted addresses upon street railway problems at various gatherings. If this practice is followed in 1906 it will do much toward securing that improved public understanding of street railway conditions which is indispensable to lasting success in carrying on the industry.

These broad tendencies toward wider fields of usefulness and a more intelligent public appreciation of electric railway development and operation in private hands are paralleled by a notable advance in the physical equipment of modern systems and by greatly improved methods of operating analysis. The evolution of the power station is still under way; the steam turbine for both direct and alternating current service is certain to win fresh laurels in the year upon which we have entered; the gas engine is coming more and more to the front—witness its adoption in part by the Boston Elevated Ry., that long-time champion of reciprocating engine units—and both rolling stock and roadbed are being brought up to standards far beyond those of even a few years ago. On the score of operating economy, the stopping of leaks now engages the earnest attention of every progressive department head, and the search for higher efficiency in men and materials is sure to be carried farther in 1906 than ever before. The creation of traffic by energetic advertising is sure to be pushed farther afield in the coming months, and there is every reason to believe that when 1907 appears upon the calendar the permanent and growing value of electric traction will be even better realized by the public at large than it is today. We are in the rise of a tide of industrial development which shows little sign of falling, and among the great forces which are today becoming more and more beneficent in their influence upon modern life, the advancing electric railway system of 1906 is certainly of incalculable prominence.

THE POPULAR OPINION OF GATES ON CARS.

One of the leading newspapers of Minneapolis very recently started an attack against the use of gates on the cars of the Twin City Rapid Transit Co. which operates a system of 320 miles of track and 750 cars in the cities of Minneapolis and St. Paul. As a means of exciting interest in the question, a popular vote was taken, the ballots being sent to the newspaper office where they were counted and the results announced through the columns of the paper. As many companies throughout the country are at times a party in similar agitations, it may not be without interest to relate here the history of the controversy in the Twin Cities.

When the question of gates or no gates was first presented to the newspaper readers, it is said that statements were made that the gates were put on the cars solely for the benefit of the railway company and contrary to the wishes of the patrons, thus exhibiting on the part of the railway company a spirit of reckless defiance. It was also said that the duty of the railway to the public did not require the use of gates.

During the time that the newspaper was calling for expressions of opinion from its readers and for votes from the population at large, the management of the railway took no active part in the agitation but awaited the announcement of the count of the votes. It was felt that in this way, the true feeling of the public, the patrons of the road using the gates, would be found, and so it was. The result of the voting clearly demonstrated that the people who ride, favor the use of gates.

In all there were 1,100 votes cast, out of a population of 261,974 served by the railway, and it is said that fully 30 per cent of those voting were in favor of the use of gates as now operated. This in contrasted figures means that but 660 people in a population of more than a quarter of a million made a positive objection to the use of gates. From the general knowledge of the class of people who usually jump at a similar chance to knock the methods of operation of any public service corporation, and especially when they can get their names in print in doing so, one can feel

quite sure that the use of gates has been highly satisfactory to the riding public of the Twin Cities. Directly after the results of the voting had been announced, and the newspaper starting the controversy had acknowledged that public opinion favored the use of gates, Mr. C. G. Goodrich, vice-president of the transit company, answered, in the newspaper advertising columns, the complaining statements earlier given. This official announcement contains some arguments and data that may be of assistance to street railway management in other parts of the country, therefore we abstract them here.

The criticism that the gates were put on the cars solely for the railway's benefit is true in part.

The statement that they were put on contrary to the wishes of the patrons could not be true as the patrons did not have and therefore could not express any preferences about the use of gates.

The statement that "reckless defiance" was shown in putting on gates is absolutely false. Our respect for "public sentiment" when it is right is supreme. When it is wrong, or based upon erroneous assumption, we frankly admit that we are afraid of it. In either contingency, however, our respect for it is entirely too healthy to meet it in a "spirit of reckless defiance."

"Street railway companies, as carriers of passengers for hire, are bound to exercise the highest degree of care and diligence consistent with the nature of their undertaking, and are responsible for the slightest neglect. This rule extends to the management of the cars and track, and to all the arrangements necessary for the safety of passengers as respects accidents from collision or otherwise."

If the placing of gates on street railway cars is an "arrangement" which will minimize accidents, and not inconsistent with street railway business, then it not only was our duty to the public to equip our cars with gates but the above ruling of the supreme court was tantamount to a mandatory order instructing our company to do so.

It will not be contended that gates to prevent passengers from getting on and off moving cars are inconsistent with the work of carrying passengers.

As to whether gates minimize accidents the following figures speak for themselves.

In the year 1894, the year before gates were installed, we had 1,655 accidents caused by people getting on and off cars.

In 1904, ten years later, notwithstanding the fact that we handled more than twice as many passengers, accidents due to getting on and off our cars numbered only 259. These figures include both cities.

If the 1894 percentage of accidents to passengers handled had prevailed in 1904 our accidents due to getting on and off cars would have been over 3,500 instead of 259.

If human life and suffering are entitled to any consideration then "our duty to the public" would seem to be apparent. We can and do understand fully that at times the gates may prove an annoyance, but taking all the conditions into consideration we do not believe or at least we do not wish to believe, that anyone familiar with all the facts in the case would wish them discarded.

No consideration of the case will be complete which does not take into consideration the fact that fully 65 per cent of our passengers are either women, children or elderly persons.

TRAFFIC CONGESTION.

The congestion of traffic at the business centers of large cities is one of the most serious problems with which the operating engineer or manager is confronted. The economic loss caused by the throttling of rapid transit foots up to a stupendous total each year. The fundamental cause of urban traffic congestion is found in the concentration of business interests within a limited area. This tendency attains its climax in the modern office building, which frequently houses three or four thousand persons during the business day, thus equaling the traveling population of a small city. Without the high-speed passenger elevator, the present type of office building would be a commercial impossibility and without rapid transit lines below, on and above the streets, the congestion of traffic at the metropolitan business centers can hardly be imagined.

A secondary cause of traffic congestion is the narrowness of the streets which constitute the arteries of maximum travel. To these may be applied the old story of attempting to force a pint into a gill flask. The density of population is so great in the larger cities that in the business districts the sidewalks are crowded to their limit and the streets between the curbs are equally crowded with vehicles. The most aggravating cause of delay in a city street traversed by cross-currents of pedestrians and street cars is without doubt the transportation of heavy merchandise in trucks and wagons.

Here, at these intersections, are the points of congestion and there is little doubt but that in the near future restrictions will be placed upon vehicular traffic and the time will come when it will not be handled in the more crowded streets. The enforcement of municipal regulations regarding right-of-way is of immense importance, for the truckman who delays, for two minutes, a line of cars carrying 1,000 people, destroys the equivalent of one man's time for 33 1-3 hours.

The custom of laying the blame for traffic congestion upon the local traction company is, in most cases, a mistake. Manifestly the conditions which make for the smooth handling of traffic are a clear track and plenty of power behind the rolling stock. In the urban rush hour a clear track is an unknown quantity, but if the vehicular traffic is properly handled and kept away from the car tracks, the conditions become as favorable for the movement of passengers as can reasonably be expected.

Elevated and subway lines are of vast importance in the relief of surface congestion, but if the vehicles carrying merchandise can be deflected to the side streets during the rush hours, it is probable that the transporting facilities of the surface lines will be increased from 25 to 50 per cent. A natural route for merchandise is below ground, and it is safe to say that before the end of another decade a great deal will have been done to restore the street surface to its normal function of a passenger highway. The pneumatic tubes and freight tunnels have begun to solve the problem in a few cities. The subway systems and elevated lines will probably continue to grow in the great cities and there is little doubt that the separation of merchandise and passenger traffic, which is sure to come, will emancipate the surface lines from the thraldom of blockades and permit a reasonable measure of rapid transit at the ground level.

Car Barns of the United Railways and Electric Co. of Baltimore Destroyed by Fire.

The car barns of the United Railways and Electric Co., of Baltimore, at York Road and Carroll Ave., Waverly, were burned early on the morning of Jan. 10, 1906. About 65 of the 100 or more cars stored there, most of them open cars, were destroyed and many more were damaged before they could be moved from the barn. Among them were seven of the new semi-convertible cars which the company has recently put into service. The loss is estimated at $100,000.

The fire originated in a mail car in the center of the north building and was discovered by the night watchman. An alarm was turned in, but before the arrival of the firemen, the employes of the company endeavored to extinguish the fire. Being unable to check its progress, they turned their attention to the work of saving as many of the cars as possible. There were about 30 of the new cars stored in the building and all were run out safely with the exception of seven. These, it is thought would have been removed in time had not one of them jumped the track at a switch, causing a blockade. This north building was only partially consumed, while the other two were burned to the ground.

When the firemen arrived they were handicapped by the fact that the fire plugs were frozen tight and it was nearly three-quarters of an hour before a full stream could be thrown on the blaze. The advantage of an effective fire extinguishing system in a car barn is thus readily apparent, as the fire could have been checked at its outset by the watchman. The fire rapidly gained headway and by the time the firemen were able to do effective work, all of the three buildings composing the barns were enveloped in flames.

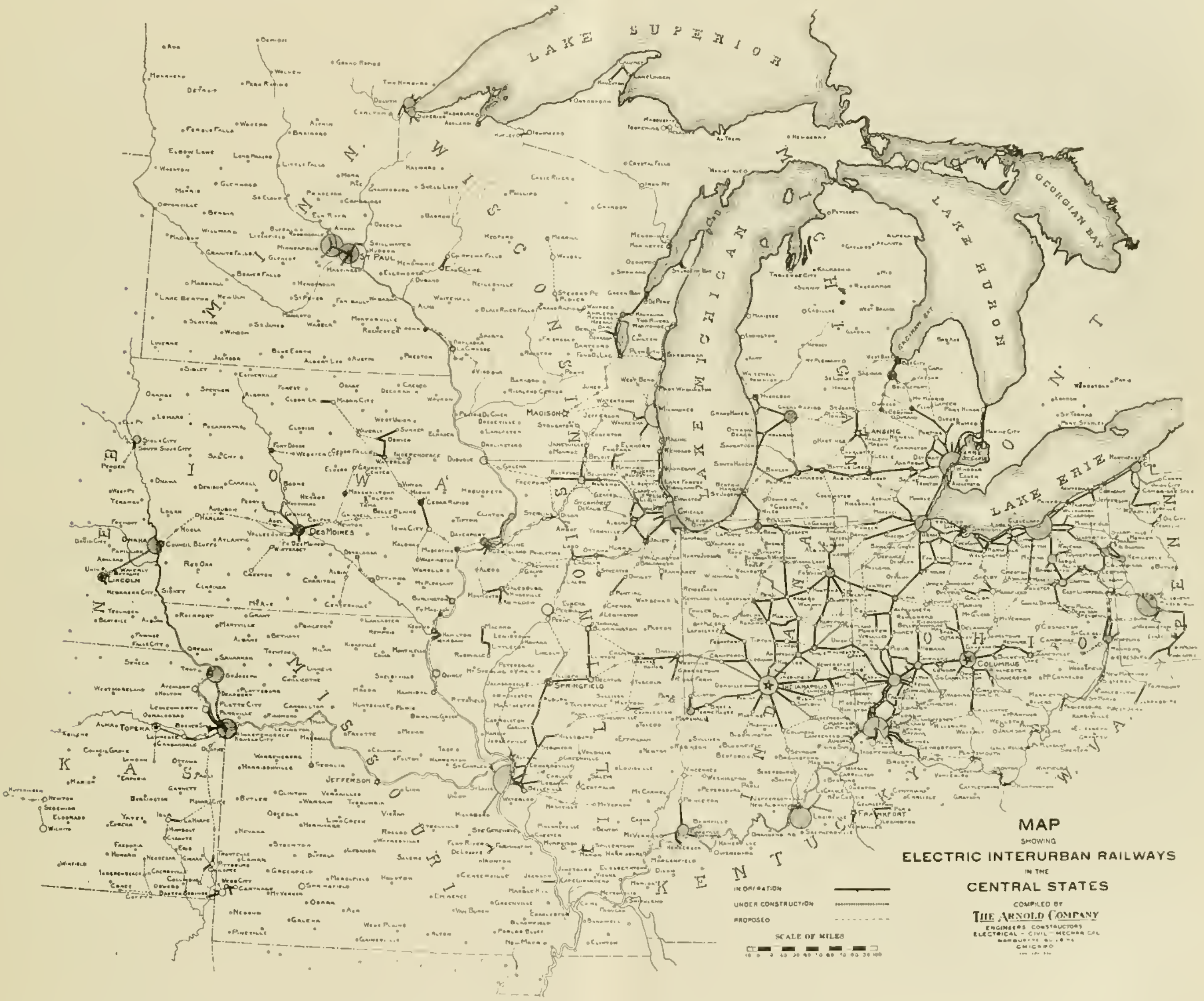
Although service was interrupted during the time of the fire, the company managed to take care of its patrons north of the barns on the York Road by making short runs for several cars which were at the north end of the line. By eight o'clock in the morning, the service was again organized and other cars were being run to all points beyond the barns.

Jas. R. Pratt, assistant general manager of the company, states that the loss is fully covered by insurance.

A Complete Interurban Map of the Central States.

For some time past the "Street Railway Review" has printed up-to-date maps showing the routes of the interurban properties in the several central states. Each of these maps has included but a single state. During the last few months the Arnold Co., Chicago, Ill., has sent out to each property in the central group of states a request for correct information as to the route of its line. These requests have been answered, with few exceptions, and the information transferred to a map, 30 x 25 in. in size, including the states of Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana and Ohio. We are pleased to be able to present to our readers a reproduction of this map at the time when the two great net works of interurban lines, one in the southern part of Michigan and northern Ohio, and the other in southwestern and central Ohio, have been joined by the completion of the Lima-Findlay division of the Western Ohio Railway Co., which is described in these pages.

It is the purpose of the Arnold Co. to reproduce the map in blue print form and furnish copies to those interested in the growth of electric railways.



Directors of the Erie R. R. have decided to parallel a large part of the main line in New York state with trolley lines. Plans have been announced recently for the construction of a 76-mile line through Binghamton and Corning, and it was stated that other lines will be built later through the more populous parts of the state.

Franchise for the New York & Port Chester Railway Co.

After fighting four years for a franchise, first before the Board of Aldermen and then before the Board of Estimate, the New York & Port Chester Railway Co. has persuaded the Board of Estimate to approve its application. The board adopted a resolution fixing terms under which the road may obtain a franchise to operate in the Bronx, but the action is tentative, inasmuch as the terms have to be advertised, under the law, for 20 days and also because the courts have not yet passed on the constitutionality of the act, giving franchise-granting powers to the Board of Estimate, instead of to the Board of Aldermen.

The franchise is to run for 25 years with the privilege of extension on a revaluation. For the first five years the company is to pay $8,000 a year to the city, $13,000 a year for the second five years, and $35,000 a year for the next 15 years. In addition to these amounts the company will have to pay 5.5 cents per lineal foot of track per year for the first five years, 7 cents per foot for the second five years, and 20 cents per foot for the last 15 years.

It is further stipulated that the company complete work to the value of $1,000,000 within five years from the date of the execution of the contract. There are to be no grade crossings, and the city is to be guaranteed from damage in operation. At least 60 trains per day in each direction are to be operated, with $50 penalty for each train under that number. The road is to be four-tracked south to 177th St., and two-tracked down to the Harlem River.

First Quarterly Meeting of the Street Railway Association of the State of New York, Schenectady, January 10, 1906.

The Street Railway Association of the State of New York held its first quarterly meeting in the Schenectady Railway Benefit Association rooms at the Fuller St. station, Schenectady, January 10th. About fifty members and guests from other states were in attendance. Some time ago it was decided that in order to obtain the best results meetings more frequent than once a year should be held. In accordance with this view and on invitation of the officers of the Schenectady Railway Co. it was agreed that the first of these conferences, as they are to be called, should be held at Schenectady on January 10th. Only men actively connected with railway properties were invited.

The conference convened at 9:30 o'clock in the morning and remained in session until 4 o'clock in the afternoon. A short recess was taken at 12 o'clock for luncheon, which was served by the railway company in adjoining rooms. There was nothing in the day's program to detract attention from the meeting. The subjects covered in Accounts Nos. 6, 7, 8 and 9, namely, maintenance of cars and equipment, were discussed exhaustively.

Car Inspection.

The discussion was opened by D. F. Carver, general superintendent of the Rochester Railway Co., who read a carefully prepared paper on the subject, "Lay-over Inspection vs. Night Inspection." Mr. Carver went into the subject thoroughly, giving data, making comparisons of the two methods and drawing conclusions. Owing to the increased expense of operating the lay-over inspection is not in general use. His company introduced the lay-over system January 4th.

President R. E. Danforth, general manager of the Rochester Railway Co., gave recorded data of a Cleveland company which finds that the extra-help expense incident to the trip inspection is more than offset by the saving in the maintenance of the car equipment. A letter from Paul Windsor giving the experience of the Boston Elevated Railway Co. was read. In part Mr. Windsor stated that his company has an inspector who goes over the equipment at night but as a rule the inspection work is done during the day and much better results obtained. Other than at the rush hours of the day no trouble is experienced with the lay-over inspection.

W. R. W. Griffin, superintendent of the Rochester & Eastern Rapid Ry., said that his company recently built a pit to be used for regular car inspection and as the operating schedule is now arranged each car has a 50-minute lay-over at the pit every four hours. This gives ample time for their inspection. The inspector looks after all the equipment and makes out a report for each car as it is inspected. All cars are given a complete overhauling four times a year.

Frank P. Maize, master mechanic of the Rochester Ry., described the earlier method used on the Rochester Ry. for keeping a record of the costs for maintaining the different parts of the car equipments, previous to the inauguration by his company, on January 4th, of the lay-over inspection.

H. P. Clarke said that though he is not at present affiliated with the inspection department of his company he had for many years previous made it a study. The first thing necessary was to ascertain whether or not cars were being inspected carefully. There are a great many rules laid down for doing this work, but a man has to get into the pit to do the inspection work thoroughly, and the man in charge must also get under the cars, in order to know positively that the work is properly done. In giving his former experiences he said that often on going into the pit and looking over the cars he had found brakes, chains and other parts in an unsafe condition, when from an exterior view they were perfectly safe. In his opinion all brake riggings should be taken down and examined every 30 days. It is not possible to lay down a set rule, however, as every manager must be governed by the conditions surrounding him.

L. L. Smith, of the Schenectady Ry., gave some statistics on operating conditions and their effect on car cleaning.

Motor Troubles.

The subject of flat spots in commutators, their causes and remedies, was next taken up and discussed briefly. Many instances were cited where these defects were caused by poor brush holders, and others where they were caused by negligent motormen. A remedy suggested for the former case is to put on new holders and turn the brushes.

H. A. Benedict, electrical and mechanical engineer of the Albany United Traction Co., said that owing to the remodeling and increasing the weight of some of the cars on this road the 30-h. p. motors which are used have proved to be of too small capacity to do effective work. He has obtained good results by putting more copper in their fields and by putting asbestos in the insulation, thus increasing the allowable temperature rise.

F. H. Lincoln, assistant general manager of the Philadelphia Rapid Transit Co., was questioned as to the organization of the mechanical forces of his company. The mechanical departments, he said, are under the supervision of night and day foremen, who report daily each car taken to the shops, giving the cause and extent of the trouble. In each case the motorman's number is recorded and if it is found that one man has more trouble than is thought necessary an investigation is made. By this system the armature expense has been greatly reduced and fewer cars are sent to the shops. At the end of each month a list of the cars brought in in poor condition and showing what per cent is chargeable to mechanical and what per cent is chargeable to accidental expense, is posted in the shop. It is found that with this scheme the men become interested and try to see who can make the best record.

Painting.

Fred Du Boise, master mechanic of the Syracuse Rapid Transit Ry., asked for a remedy for grease "pin-point" spots which often accumulate on the paint of interurban cars. His company washes its cars with castile soap but he was not certain it was as good as a linseed preparation. Advocates of both materials as a wash were free in giving their experiences. Representatives of other roads where nothing but water is used in washing exterior work also reported good results. Costs for keeping cars in an attractive condition were given but the question of the proper method of washing was left open.

It was suggested that the color of paint used on the cars had much to do with the amount of washing required. This led the assembly into a discussion as to the best colors for interurban and city cars.

T. W. Wilson, general manager of the International Ry., said his company has had trouble, in repainting sections of red cars, in getting the colors to match, the red, when exposed, changing in shade. It has about been decided to adopt a dark green color for its city cars similar to that used by a large number of steam roads. Already 12 cars have been repainted as an experiment. The interurban cars will be left with a yellow exterior, as it is believed this color aids in lessening the number of run-aways and other accidents.

President Danforth said that the Rochester Railway Co. had found that after three months' wear red cars have a bad appearance. His company now uses a yellow paint of its own manufacture that has proven durable. It has no noticeable effect on the varnish. Mr. Danforth stated further that in his opinion dark colored cars, used on city lines, presented a dingy appearance, and as a result the company does not get credit for its fine rolling stock.

Several others gave their experiences with various colored paints, some of which thought the fact that steam roads, who have to contend with coal dust and soot, use a dark green color should offer no precedent for electric companies, that have only dust to care for.

Lubrication.

Lubrication was next discussed. During the discussion of these subjects recess was taken for lunch.

President Danforth said that the Rochester Ry. has tried all

kinds of oil cups and improvised an automatic feed for the various journal boxes but has not yet found one that is perfectly satisfactory. W. J. Harvie, electrical engineer of the Utica & Mohawk Valley Railway Co., said that his company uses both grease and oil and though he has many oil cups on test has not yet found one to answer the purpose under all conditions.

Many others spoke of the different methods used for applying oil and grease to journals.

H. P. Clarke outlined the theory of lubricating and the functions of a lubricant. In part he said that a lubricant must be chosen to suit the conditions. Nearly 50 per cent of all the oil used by the average company is wasted. It requires only a small amount of oil to do the work effectively, if it is properly applied. One of the principal problems to solve is to get the desired result without using too much oil. Through the free use of oil, he said, a great deal of damage is done to sensitive machinery near the different journals. Mr. Clarke uses oil cups of his own design.

Trolley Wheels.

The subject of trolley wheels and the different types and makes was next discussed. Figures given brought out interesting comparisons between the wheels made by different concerns. The life of a common 6-in. wheel varies, according to statements made during the discussion, from 4,000 to 7,000 car miles, depending in part on the kind of trolley support used and the tension of the trolley pole spring.

The relative cost of maintaining different types of motors was then discussed. It was stated that a Pennsylvania road scraps its worn out motors and replaces them with new ones. The cost of the new ones is charged to maintenance, and by applying the scrap money toward paying for the new motors the equipment is in good shape at the end of the year and no great expense has been incurred. This method was thought to be a good one.

Brakes and Brake Rigging.

Brake shoes, hangers and kinds of rigging best fitted for general purposes were next discussed. Messrs. Graham, Maize, Clarke, Harvie and others related their experiences with different brake shoes and submitted data of experiments that have been made in trying to prolong the life of certain classes of shoes and hangers.

Mr. Harvie asked for a good method for shopmen to follow to make sure that hand brakes, on cars with airbrake equipment, are in working condition. It was stated that in Buffalo the hand brake is always used from 10 to 11 o'clock every morning and if any of the brakes are found to be in poor condition the car carrying that brake is sent to the shop at once. Mr. Du Boise said that his company has a rule that hand brakes be used on all heavy grades.

Other subjects discussed were on controller troubles, value of the automotoneers, methods of taking care of flat wheels and use of sand cars.

As a direct result of this meeting the urgent need was advocated for having the compiled statistics of the various items of mechanical records of all roads, which are members of the New York association, gathered and submitted to the members for the purpose of making comparisons of the relative costs. It was ordered that a committee of five, including the president and secretary of the association, be appointed to gather such information and place it in form suitable for use by any member. Such records will soon be gathered from the different roads of the state and tabulated.

It is expected that another conference of the New York state association will be held early in the spring but the date and the place of meeting were not announced.

A large number of those present accepted the invitations of the Schenectady Railway Co., the General Electric Co. and the American Locomotive Co. and became their guests Thursday and Thursday night, January 11th. During the day the Schenectady Railway Co. arranged for special cars over its lines radiating from Schenectady and many of the guests took advantage of this opportunity to inspect the nearby properties.

The Interborough Rapid Transit Co., of New York City, is now carrying an average of 1,250,000 passengers a day.

An Electric Line in a Cemetery.

The opening of a private electric line in Loudon Park Cemetery, Baltimore, Md., illustrates another interesting location for trolley cars. The line is owned and operated by the Loudon Park Cemetery Co., of which Mr. Henry F. Thompson is president and Mr. Frank Primrose secretary-treasurer. The road has been installed for the convenience of the cemetery lot-holders. The grading of the road was completed on November 11th. The road was formally opened on November 15th with a luncheon in honor of the Maryland Funeral Directors' Association, tendered them by the Loudon Park Co.

MAUSOLEUM AND CARS IN LOUDON PARK CEMETERY.

The road is about a mile in length and will be further extended as the needs of the cemetery require. The track starts at the main entrance to the cemetery on the Frederick Road and passes directly in front of the receiving vault, where a special side track has been put in to accommodate the funeral car. Continuing, the route takes a southerly direction, following closely a small stream which flows through the grounds, through the old portion of the cemetery. Thence it runs westerly to the proposed Wilkens Ave. entrance, where it is intended to have the line connect with the Wilkens Ave. tracks. Switches will be built at convenient points, so that the cars can be run to within a short distance of the lots. Connection with the Frederick Ave. line will shortly be made, so that the funeral car of the United Railway & Electric Co. may be run directly to the receiving vault.

The track is built of 60-lb. T-rail and is ballasted with stone. The rolling stock consists of two cars—the Loudon and the Linden—shown in the accompanying illustration. The cars were built at the shops of the United Railways. They are painted black with gold finishings, the inside finishings being of quartered oak, while the floors are covered with velvet carpet. They have large windows, resembling an observation car.

The Loudon has large and comfortable cane chairs, while the Linden has the side-seat of the regular trolley car. They will each seat 20 people and will carry 10 more without crowding. These cars will be run daily on a regular schedule and transportation will be free to lot-holders.

Power for the line will be supplied by the United Railways & Electric Co.

A New Traction Merger.

It is stated that the Tri-City Railway Co., of Davenport, Ia.; the People's Power Co., of Rock Island and Moline Ill., and People's Light Co., of Davenport, the Davenport Gas & Electric Co. and the Davenport & Suburban Railway Co. will soon be under one management. It is also said that the man who has been handling the arrangements is George Kobusch, of St. Louis, president of the St. Louis Car Co., and that St. Louis and New York capital is involved.

Some Recent Convictions of Fraudulent Accident Swindlers.

Through the courtesy of Mr. B. B. Davis, secretary-treasurer of the American Association of Street Railway Claim Agents, we are able to publish the following interesting accounts of the conviction of fakirs.

An early result of the unified efforts of members of the association was manifested a few weeks ago when Frank J. Hart, a well-known "accident man," was reimprisoned after having been released from a three-years' term in the Eastern Penitentiary at Philadelphia. He was quickly re-arrested on another charge, convicted, and imprisoned in New Jersey.

Hart had associated with him his wife, who was known as Beatrice Graham. They were at the head of a gang of some 14 men, and made their headquarters in a dilapidated building on Broadway, New York. They operated extensively in New York and surrounding cities and once secured a verdict of $10,000 against the Pennsylvania R. R.

Another conviction brought about by the association, and which was described in "The Street Railway Review" for September, 1905, was that of a trio composed of Edward L. Pape, John Willmott and Joseph Burns. The gang operated in Philadelphia, Buffalo and Cleveland. Pape is now serving a term in the Eastern Penitentiary at Philadelphia, while Willmott and Burns, preferring conviction on a lesser charge, confessed to highway robbery in New York City, where they were convicted and given seven-year sentences. They were arrested by Mr. H. G. Silcox, of the Philadelphia Rapid Transit Co's. detective service.

Another swindler who was successful in deceiving physicians and claim agents is William J. Doran, an acrobat and contortionist, who became so skilful in allowing himself to be struck by street cars that he was sometimes tossed for a considerable distance. His first attempt at "getting hurt" was made in Camden, N. J., and brought him $100.

Doran pursued a rather unique method of operation. He would permit himself to be struck and then have himself conveyed to a room, where a confederate would be bandaged and put to bed to await the coming of the claim agent, leaving Doran free to get "hurt" again. One night he was struck three times by trolley cars, and upon another occasion managed to keep several men in bed doing business with the claim agents. He was finally captured and sent to join three confederates in prison.

Another excellent piece of detective work on the part of Mr. Silcox was the conviction of the members of the notorious "Rabbit's Foot Social," of Camden, N. J. This organization, the leader of which was a young law student named Partridge, succeeded in obtaining $2,500 from a steamship company. In order to gather evidence Mr. Silcox joined the "social." Partridge was convicted and sent to prison. The others plead guilty, but sentence was suspended, and they left for parts unknown.

Mary Ellen Seivert, alias Mary King, operated in a number of Eastern cities and also directed her schemes against the steam railways. Her arrest and conviction were due to the efforts of the association.

Mrs. Agnes McKibben was at the head of a notorious gang of women in Philadelphia, which included Mary E. Tiernan, Alice McDermott, Annie Ralston and two children of Mrs. McKibben. They had filed 19 claims before they were convicted and the four women sent to prison. The same scheme was pursued in all these accidents. In boarding or leaving a car, or in standing in the aisle as it started, one of the women or children would fall and pretend to be badly hurt. Settlement with the company would be effected for any sum that could be obtained, varying in amount from $5 to $75.

The foregoing comprise a small portion of the many convictions the members of the association have brought about. It is not thought that this remarkable class of swindlers will long survive such vigorous treatment.

The Metropolitan Street Railway Co., of New York City, has been pursuing a vigorous policy of action against these crooks, and through the courtesy of Mr. James L. Quackenbush, general attorney for the company, we are able to present some recent results of this action.

On Dec. 22, 1905, Isaac Bloom was given a sentence of seven years in the state prison upon his being convicted of perjury. Bloom brought suit against the Metropolitan Street Railway Co., claiming that he had been thrown while alighting from a car on Second Ave. on Dec. 9, 1901, and that he thereby received a shock which caused paralysis of one side of his body. Upon the trial of the case the attorney for the Metropolitan proved that Bloom had been paralyzed a long time before the pretended accident and that no such accident happened. The jury found a verdict against him, and he was thereupon arrested for perjury upon a warrant sworn out by Mr. Quackenbush.

It further appeared in the case that Bloom's attorney, Henry L. Slobodin, lived in the same house with him. Charges have been preferred against this attorney and are now pending before the Bar Association. Bloom called as witnesses to the pretended accident three persons, who, it is said by the representatives of the Metropolitan, came from Albany to New York to attend the trial in a body. It is further said that some of these witnesses will also be prosecuted.

On Oct. 17, 1905, Albert Woods and Mae Woods, his wife, were sentenced to terms of from three to five years in the state prison at Sing Sing and from two to three years in the state prison at Auburn respectively, upon their pleas of guilty to the indictment charging them with perjury in an action against one of the lines of the Metropolitan Street Railway Co.

It appeared that Woods was working on the road under an assumed name and that he put in a report of an alleged accident to a woman by the name of Mae Herbert. She brought an action against the road, alleging severe injuries, and another action was brought in the name of John Herbert, claiming to be her husband, for expenses and loss of his wife's services.

Upon the trial of the case, Mr. Ambrose F. McCabe, assistant general attorney of the Metropolitan Street Railway Co., proved that the plaintiff, Mae Herbert, was the wife of Albert Woods, and the jury found a verdict in favor of the company. The attorneys who had brought the action then made a motion to discontinue the action for the alleged John Herbert, and this was granted. The company did not let the matter rest here, however, but as soon as it had secured the necessary evidence, procured the indictment of the man and woman, with the result mentioned.

After their sentence they went before the grand jury, and, upon their testimony and other evidence, the grand jury indicted of the crime of subornation of perjury Alpheus S. Frank and Frank M. Hardenbrook, the two lawyers who had charge of the alleged Herbert case. They have not yet been brought to trial.

Announcement of the Annual Meeting of the Northwestern Electrical Association.

The fourteenth annual meeting of the Northwestern Electrical Association will be held at the Great Northern Hotel, Chicago, commencing at 9:30 on Wednesday morning, January 17th.

An unusually fine literary, business and entertainment program has been arranged, and an interesting and instructive time is assured to all who attend this meeting. The Western and Central Passenger Associations have granted a one and one-third round trip rate from all points in their respective territories.

Following are the titles of the papers to be read during the sessions:

The Proper Handling of Consumers' Meters, Geo. H. Barrett.

Modern Underground Construction, W. D. Burford.

Suggestions for Increasing the Power Output of Central Stations, P. H. Korst.

Government Tests on Fuel, C. S. Davidson.

The Organization and Development of New Business Departments, George Williams.

Successful Applications of New Business Methods, John S. Allen.

The Economics of Combined Railway and Power Plants, Ernest Gonzenbach.

The Effect of Load Factor on Station Costs, R. W. Kimball.

The Public Service Corporation of New Jersey is operating a special car service for theatre parties, weddings, funerals, excursions, etc. A car has recently been equipped with furnishings which assure the company's patrons "Pullman Car" comforts.

Piping and Power Station Systems.—XIII.*

BY WILLIAM L. MORRIS, M. E.

This same style of valve, Fig. 100, is used as a governor to maintain a constant pressure higher than atmospheric pressure. The spring then is in compression and the valves close in the reverse direction from that shown. In other words, the increase of pressure under the diaphragm causes the valve to close. The independent crank and fly-wheel dry vacuum pump is ordinarily supplied with a fly-ball centrifugal governor and a small air cylinder and piston that act upon the governor valve in conjunction with speed control, as shown in Fig. 101—(A4-13).

This same style of governor is also used for air compressors working above atmospheric pressure. This style of regulation is quite satisfactory, the air cylinder comprising only a partial control. There is another feature of governing that will require consideration in case stack fans and force-draft fans are used. An installation of this description brings into consideration numerous details that should be dealt with as a whole and not separately. For instance, it may be desirable to install an induced-draft and fan engine, forced draft for stokers with a separate engine, and coal feeding mechanism. It has been customary to place independent governors on each of these three drives and allow any one of them to increase or decrease in speed as determined by its own governor. That is, the fan engine may slow down before the coal feed or air blast engine and cause furnaces to discharge gases out of the fire doors, etc. Again, the coal feed may speed up before the air blast, causing a waste of the gases; or the air blast may speed up without coal, causing loss of heat units in heating useless air.

These three elements should have a better system of control than a separate governor for each. When one is increased they should all three be increased, and vice versa. The governor should control all three. One steam governor to increase or decrease the pressure for the three would be wholly useless. This is a peculiar condition to contend with for the reason that no present form of governing will properly meet this condition and it is a condition that very materially affects the efficiency of the plant. Assume that the pressure is very high and that the three services are running at their extreme low speed. Now undertake to adjust the induce-fan governor to run the engine at such a speed that it will just allow the pressure over the grates to be atmospheric pressure.

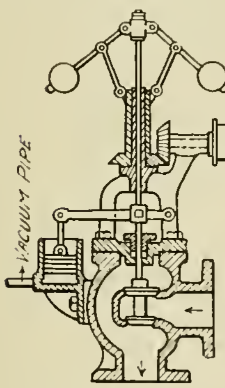


FIG. 101—(A4-13).

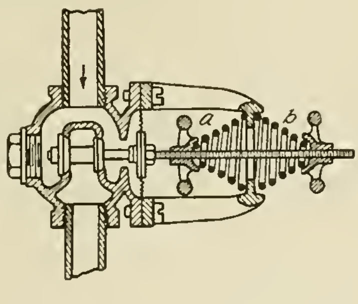


FIG. 102—(A4-14).

or say 1-10 in. of water by the draft gage. Note the quantity of air and adjust the coal feeder accordingly; there are then the three elements working in a most economical manner. Leave the governors as adjusted and allow the plant to run up to full capacity and then note the conditions again. It will be found that the steam pressure is about 10 lb. lower than usual, the blast fan is running at a frightful speed, stokers are running at a good speed, and the stack fan has not increased as much proportionately as the other two. The operating conditions are wretched, showing poor economy, furnaces smoking, blast engine fairly pounding itself to pieces—and for all, the governors are working "perfectly"; the fault lies in the system of governing.

It is unreasonable to expect three governors, possibly of different size, or make, and for three entirely different services, to "measure" out the requisite steam. To-day, when running one-quarter capacity, the fan engine may want 50 lb. of steam per hour to maintain the proper speed to discharge the gases corresponding to one-quarter capacity. The blast engine may want 65 lb. and

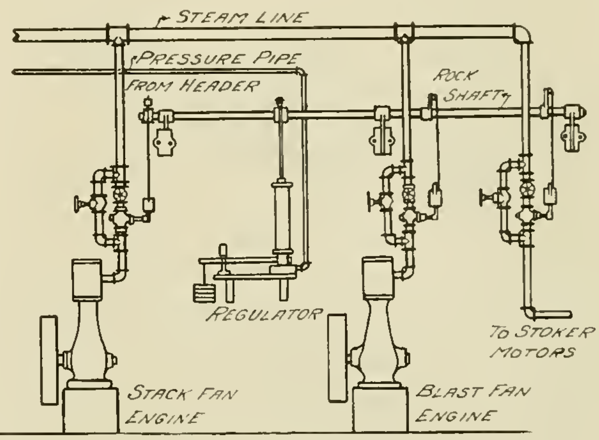


FIG. 103—(A4-15).

stoker drive 20 lb. For one-half load the requisites may be 70, 90, and 30 lb. respectively, and for full load 85, 115 and 45 lb. Any of the three requirements would be varied by tightening the packing, or making any other adjustments.

The ordinary governors are adjustable so that a certain delivery of steam will be obtained at the particular pressure set. For any other pressure the steam discharge may be almost any amount, and whatever it is, the operator can not control it in any way. The governor, to be suitable for such service, should be so constructed that it will permit a flow of a certain number of pounds of steam per minute at lowest pressure, and should be adjustable also for a certain volume at the higher pressure. Such a governor is not on the market. Without it no three machines or even two machines can be worked economically except at one particular rate of coal consumption. There are two methods of arranging this style of governing. One is to arrange the governors so that their range as well as their normal pressure can be adjusted. This detail is shown in Fig. 102—(A4-14).

Ordinarily the spring "a" would be the spring to balance the desired steam pressure. By having a counteracting spring "b," the movement of the valve stem through the range of pressures can be varied greatly. For instance, if the tension is taken off spring "b," the travel of the valve stem may be ¼ in., while steam pressure is varied between 150 and 160 lb. When tension is put on spring "b," additional strain would be required on spring "a." By increasing the strain on both springs the travel of the stem for 10 lb. variation may be reduced to 1-16 in. or even less.

The other method of governing is as shown in Fig. 103—(A4-15.) The stack, blast, and stoker motors would each have a rolling type of valve with a slotted lever, and a rock shaft which would also have slotted levers. The shaft would be rolled by means of a standard damper regulator, the shaft being located possibly at the upper portion of the boiler front. Each of the three valves can be separately set for slow speed and high speed conditions. The speed changes would be effected simultaneously on all three valves. The

damper regulator can be set so that within 3 lb. variation the engines may be running from no load to full load. This arrangement would be far more reliable and sensitive than separate governors. In case natural draft is used instead of a stack fan, then the rock shaft would operate the dampers instead of the stack fan engine. Counterweights would be placed on the valve levers, keeping all lost motion out of the parts, and enabling them to be made in a comparatively crude way.

An accurate system of regulating furnace auxiliaries will save not less than 5 per cent of the fuel, and for a plant of 3,000 kw.

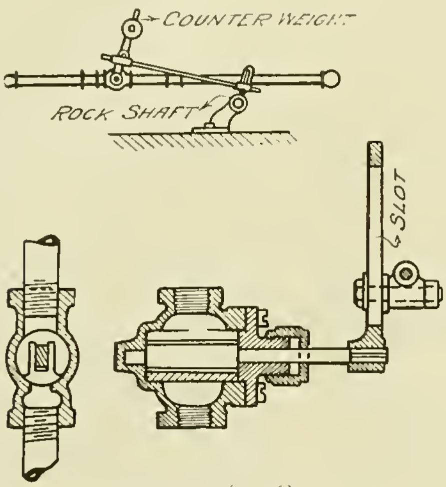


FIG. 104—(A4-16).

a saving of five tons per day at $1.50, or $2,750 per year would be shown. The system shown in detail A4-15, Fig. 103, would cost possibly $100 more than independent governors, and would involve some study and trouble for the engineer. The valve for this work should be of the corliss type, with the engine lubricator placed above it, so that the valve also would be lubricated. The valve shown in Fig. 104—(A4-16) would be very suitable.

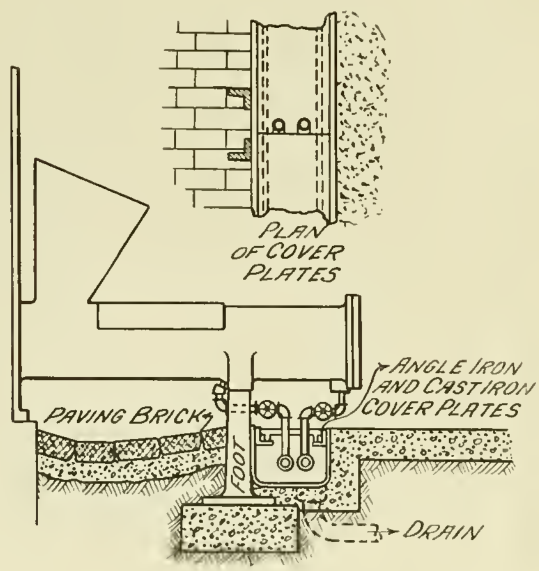


FIG. 105—(A5-1.)

This valve requires more effort to open than a balanced valve, but it closes much tighter, and since there is ample power available with the damper regulator, a valve such as is shown in detail A4-16, that opens and closes slowly, is much easier to adjust and will stay adjusted. Any valve of the globe valve type opens too quickly for close regulation. This valve is the standard "throttle valve" with a slotted lever instead of a hand lever. The by-passes and valves permit any one of the three machines to run temporarily at a higher or lower speed, and at the same time the fixed regulation is not altered.

PIPING DETAILS FOR STEAM BRANCHES.

The steam lines to an under-fed type of stoker should never be buried, but may be placed in a trench, as shown in Fig. 105-(A5-1), which arrangement is satisfactory if the trench is well drained. If the drainage is poor any water such as waste from wetting down ashes will collect in the trench and be evaporated on contact with the live steam pipes, the steam thus formed interfering with the work of the attendants.

The steam pipes for the stokers should not be covered in any way and the supports should be such as will permit of free expansion and contraction. With the trench as shown in the figure a set of cover plates as also shown, should be used. The drawing shows the cast-iron cover plate supported on angle irons. If there is a basement under the boiler room the stoker steam mains can easily be supported under the floor.

To obtain the best results with steam stokers it is advantageous to arrange the piping so that there will be a downward flow from the feed mains to the piston cylinders and through the exhaust. This detail necessitates the placing of the steam-con-

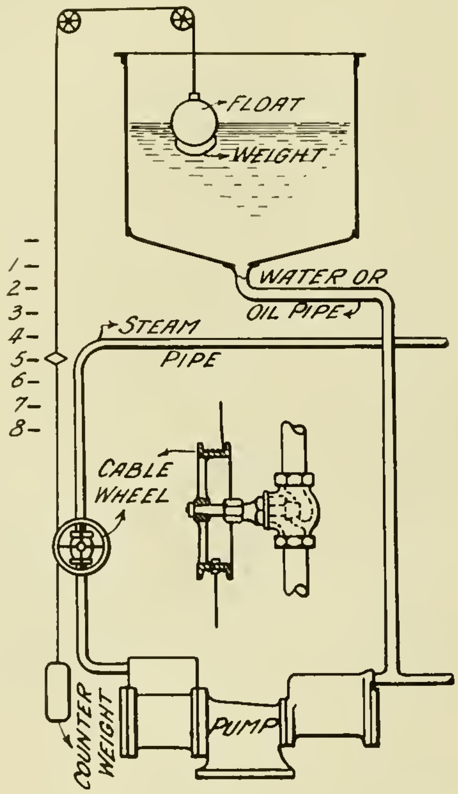


FIG. 106—(A6-1).

trolling valve above the steam line to the stoker rams, and the exhaust main below the cylinders. If the same main is used for steam and exhaust alternately it should be placed below the cylinders with the steam-controlling valve above and the exhaust-controlling valve below. To avoid water hammer in the pipe line, the drips should at all times have a downward flow and those drips collected in the low down main should be discharged at the low point, even though the exhaust is made from a higher level.

In feeding steam to the cylinders of tank pumps it is often possible to use the type of pump controller shown in Fig. 106-(A6-1), which is more satisfactory than a pressure-operated governor. By referring to the illustration it will be seen that this type of controller consists of a needle valve, operated by a cable connected with a float in the elevated tank. The cable is wound around a drum or cable wheel mounted on the stem of the controlling valve. If the relative dimensions of an installation similar to that shown in Fig. 100 are such that the tank is 6 ft. high and the valve requires 3 turns to give the pump full speed, when the rim of the cable wheel travels 2 ft. per revolution, then the cable wheel will be 8 in. in diameter and have 6 grooves with the end of the cable secured in the center one. If the cable is 3-16 in. in

diameter, the wheel flanges would be 1¼ in. apart. A 12-in. float, combined with a counterweight weighing 17 lb., will give an ample pull on the valve of a size ordinarily required for controlling the steam to a tank pump. With the arrangement as shown the counterweight is directly below the float cable and thus the strains on the valve stem are not severe. The needle valve used should be of the slow-opening type of globe valve. In order to provide for operation of the pump independent of the float it is desirable to run a by-pass around the controller valve.

The arrangement of governor construction just described permits the pump to be run at speeds varying directly with the quantity of water or oil in the tank. It also furnishes the desirable feature of keeping the pump in operation at nearly all times, thus preventing interruptions from condensation. The tell-tale shows the level of the fluid in the tank, even though the operation of the valve and its counterweights is interrupted. For installations where the storage tank is located, at some distance from the pump, or where the pump is required to deliver water for other purposes and at different pressures, it may be found advisable to place a float valve at the tank to shut off the supply and use a pressure regulator to control the steam to the pump.

The piping for steam to smoke consumers or oil burners would come under class A-7, but these details will not be considered here; a smoke consumer, by reason of the destructive effects on boilers, should be used only in exceptional cases; oil burners are installed by their manufacturers and the piping laid out more according to builder's details than general piping designs.

In arranging the piping for soot blowers, the steam should be taken from a separate main and not from the boiler. The independent supply is quite necessary in order to enable the clearing of the tubes of a boiler when it is out of service. Openings for soot blowers should be provided at the sides of the boilers. The detail design and arrangement of the soot blower piping is shown in Fig. 107-(A8-1). The branch main for the steam supply to the blower should be strongly supported so that it may withstand the hard pulls and jerks of the operator. A quick-closing valve, located as shown in Fig. 107, will partially relieve the hose of the pressure while blowing and entirely cut off the steam when the blower is being moved from one part of the boiler to another. This quick-opening valve should be attached to the hose and not be a portion of the fixed piping; the tight-closing valve as shown should be used only as a stop valve, since if it were used as a throttle it would soon become leaky. Any slight leakage in the

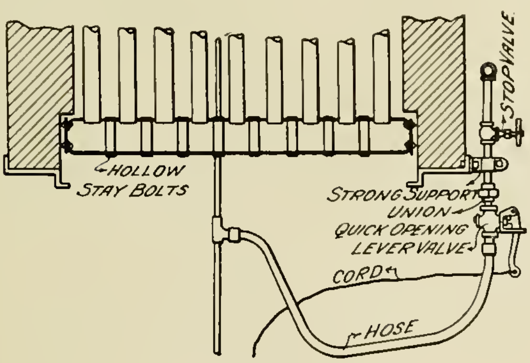


FIG. 107—(A8-1).

balanced-lever valve will not interfere with the operation of the cleaner.

The subject of soot cleaning appears quite simple, but nevertheless there are many plants running on very poor economy because they cannot clean soot and deposit from the tubes. It is no uncommon thing to find 500-h. p. water-tube boilers set with a 3 to 4-ft. passageway and tiled for vertical passes. The outside measurement of such boilers is about twelve feet. Good economy can be secured with vertical passes only when ample provision for cleaning is provided. Horizontal passes permit the use of long blower tubes operated from front and possibly the rear of the boiler setting, thus enabling much more thorough cleaning where it is necessary to place wide boilers with narrow alleyways.

A steam by-pass to the exhaust heater or heating system is provided to furnish live steam to the exhaust heater when there is but little exhaust and high temperature water is desired. The valve shown in Fig. 97-(A4-9) can be used for this service with the steam flow as shown. Such a valve should be small and have a very large diaphram. A light spring should be used to balance a pressure of say one or two pounds per square inch on the diaphram. Ordinarily when there are differences in pressure of from 2 to 160 lb., it is found more satisfactory to use two regulators of the same design, one reducing to about 60 lb. and the other to the pressure on the heater.

There is a rather peculiar feature in connection with machinery, the back pressure steam from which is used for heating water or buildings. When the demand for low pressure steam increases the back pressure is reduced, at the same time the amount of steam

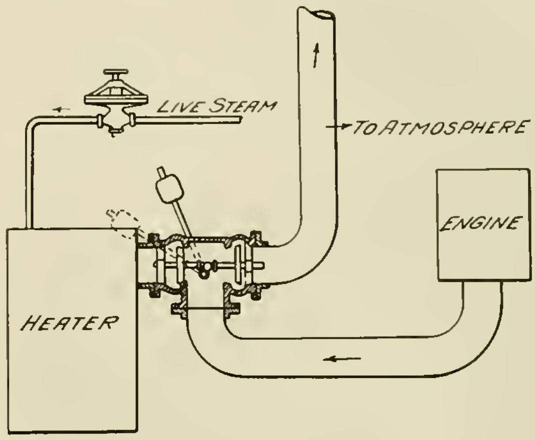


FIG. 108—(A9-1).

being delivered by the machine is also reduced. When less steam is being condensed in the heating system the back pressure rises and thus compels the engines to take more steam to perform the same work. This wastes steam to the atmosphere. The heater control should be such that when the back pressure drops, the engine should take more steam and when the back pressure rises, the engine should take less steam, this being the reverse of the usual practice. In other words, when the back pressure tends to rise, the engine should be allowed to exhaust to the atmosphere and be relieved of all back pressure, and the pressure on the heater should be allowed to drop before the engine exhaust is again discharged into the heater system. Thus the amount of steam used from the engine would be reduced.

In Fig. 108-(A9-1) is shown a valve arranged to perform these duties. When the valve is open to the atmosphere the weight exerts a pressure per square inch of say 2 lb. against the heater pressure and when the valve is down it exerts a pressure of 4 lb. against the port to the atmosphere. This range may be increased, say, from 6 lb. back pressure to 1 lb. heater pressure by positioning the lever on the valve stem and by varying the location of the weight on the lever. Such a valve enables the engine to exhaust to the atmosphere all the steam that a heater or heating system does not condense. The valve is now on the market, being used as an atmospheric valve in connection with a condenser, the condenser taking the place of the heater as shown. The lever should roll on a rock shaft similar to that shown, so that the weight will neither pass nor stand over the center of this shaft. If this valve is adjusted so that it closes against atmospheric pressure at 3 lb., then the live steam by-pass should be set to be open only on pressure below 2 lb. This will avoid blowing live steam into the heater while the engine is exhausting to the atmosphere.

Whistle connections cause considerable annoyance due to condensation accumulating in the pipes before the whistle is used. The connection shown in Fig. 109-(A10-1) will allow condensation to accumulate at the top of the valve and requires blowing through the whistle before the tone is right.

The connection shown Fig. 109-(A10-2) necessitates a hole through the roof for the whistle cord and allows considerable condensation of steam in the pipe, which is especially undesirable if the pipe is long.

The latter style of whistle connection is quicker to operate and produces the correct tone as soon as opened, but for a long run of pipe the detail shown in Fig. 109-(A10-3) will be found more satisfactory as it allows the whistle valve to be placed low down, and the upper pipe to be well drained until the steam valve is opened. The drain closes simultaneously with the opening of the steam valve.

The steam branch to an ejector vacuum trap is for the purpose of breaking the vacuum and discharging the condensation. There is considerable mechanism in these devices because they contain automatic features which permit the steam to blow out condensation immediately following the closing of the vacuum drip line to the trap. The piping details of ejector vacuum traps have no special piping features.

The steam required for a heating system would not ordinarily be very extensive in a power station, but in case heat is to be provided for car shops and neighboring buildings some special arrangement in station piping system and machinery may be justified so that exhaust steam will be available and can be used for heating. This will be taken up under the details to be later considered in Class C.

Live steam heating should be avoided wherever possible. The high pressure of the steam causes leaks at stuffing boxes, joints and similar connections that will give no trouble at low pressures. To stand high pressures the heaters must be in the shape of pipe coils, and if steam at 160 or 170 lb. be used it is liable to injure whatever it comes in contact with. However, for a condensing plant there is no other system suitable if there are but one or two rooms to be heated. Exhaust steam from auxiliaries, when piped to a heater, is not sufficient in amount to maintain a pressure which will allow the distribution pipes to be of any considerable length. The rooms to be heated are generally the chief engineer's office, lavatory, stock room and an oil room. The use of electric heaters would not be justified because the cost of their installation would equal steam heaters and the cost per B. t. u. of radiation would be possibly 50 times that of steam heating.

If there are but three or four rooms to be heated there is practically no better method in a condensing plant than to use live steam. The temperature can be regulated, as shown in Fig. 110-(A12-1), by allowing more or less air to remain in the heater. The air will lie below the steam and just above the condensation. The drips from the heating coils should discharge to the atmospheric exhaust line. This discharge will save the water of high temperature, together with any leakage of steam passing the trap and avoid difficulties attendant upon exhausting drips to a sewer, which practice not only injures the sewer, but causes steam to leak from the catch basins.

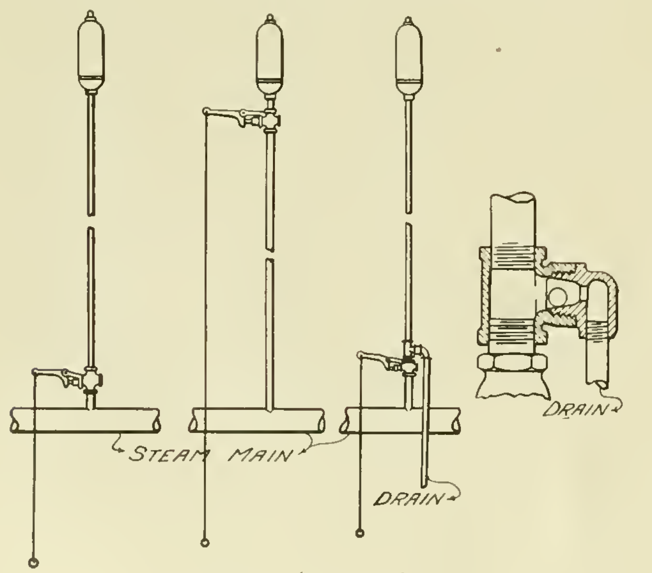


FIG. 109—(A10-1, 2, 3).

The coils should be laid out so that the pipes will run into a corner and return, allowing free expansion and contraction. Such expansion is very severe in a stiffly connected live steam heater. The corners should be made of pipe bends, but bends for connecting purposes will necessitate unions at either end of each pipe. A simpler method is to use elbows and right and left thread connections in the short return.

Another method of regulating the temperature of a live steam heater is as shown in Fig. 110-(A12-2). In this arrangement the steam valve is a hand controlled throttle; the drip valve has a very small hole drilled through the disc. While in operation the drip valve is kept closed, the discharge of drips being through the small drilled hole. The principle of this detail is more complex than it would at first sight appear. For every varied amount that the steam valve is opened a balance is established in the heater coil. By increasing the opening of the steam valve a greater pressure is exerted in the heater, and a greater quantity of drip is discharged through the lower valve. The condensation, or air, is discharged until the increased heating or condensing surface reduces the pressure in the heater, simultaneously reducing the drain through the lower valve. When the upper valve is further closed the pressure in the heater is reduced, the discharge at the lower valve is retarded until the heating or condensing surface has been reduced by increased condensation to the point when the pressure is about to raise and increase the flow of drip.

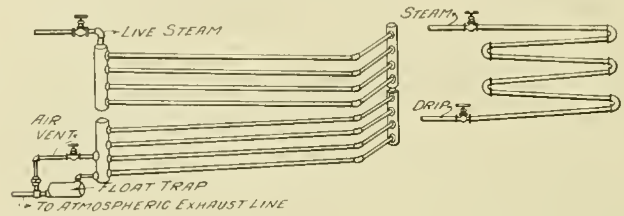


FIG. 110—(A12-1, 2).

(To be Continued.)

Prizes for a Trade Mark.

Realizing the desirability of having some distinctive emblem to characterize its property, stationery and general literature, the Northern Ohio Traction & Light Co., Akron, O., has decided to adopt an appropriate trade mark. The company has invited the public to assist in the selection of this trade mark by suggesting designs. Prizes to the amount of $50 will be distributed, $25 for the first prize, $15 for the second and $10 for the third.

By way of example attention is called to the emblems used by the various railroad companies—such as the artistic arrangement of names, initials and colored designs. The drawings or sketches must be simple in design and at the same time the suggestion conveyed must be sharply and comprehensively defined. The drawing may be of any size suitable for reproduction, the medium used being either ink, wash or oil. No pencil drawings will be considered.

All suggestion-designs must be submitted by Jan. 18, 1906, and any one is eligible to compete for these prizes.

The Stanislaus Electric Power Co.

It is announced that the large hydro-electric enterprise which is to be developed by the Stanislaus Electric Power Co. in the central portion of California has been financed and actual construction begun.

The project includes the construction of a power plant, the establishment of storage reservoirs at the head waters of the river; a diverting dam near Sand Bar Flat in Tuolumne County; a flume and ditch system 15½ miles long, with a capacity of 300 cu. ft. of water per second; a large equalizing reservoir above the power house site; a system of pipe lines, which will deliver the water to the power house under a head of 1,500 ft.; a power station, equipped with water wheels and electrical apparatus of a capacity of 20,000 kw.; and a transmission system which will provide for the distribution of power to a market within a radius of 150 miles of the power house.

The Knickerbocker Trust Co. of New York is the trustee for the bond issue, which is to be $10,000,000. The engineering and construction work is to be in charge of Sanderson & Porter, engineers, New York City.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Kenfield Publishing Co. under the title "Street Railway Law," five volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901 to 1903; Vol. V. from April, 1903, to August, 1905. Price: Bound in sheep; five volumes, $12.00; single volume, $3.00. Bound in buckram; five volumes, $8.00; single volume, $2.00.]

DUTY WHEN STOPPING OF CAR JUSTIFIES BELIEF OF INVITATION TO ALIGHT.

Selby vs. Detroit Railway (Mich.), 104 N. W. Rep. 376. July 24, 1905.

When a street car is stopped under circumstances which justify a passenger in believing that he is invited to alight, it is a reasonable and universal rule, the supreme court of Michigan says, that the conductor must not start his car while the passengers are in the act of alighting.

DUTY IN SELECTION OF PLACE FOR LANDING PASSENGERS.

Macon Railway & Light Co. vs. Vining (Ga.), 51 S. E. Rep. 719. Aug. 4, 1905.

A charge to a jury that it is the duty of a street car company to select a reasonably safe place for landing passengers, wherever it may stop a car for that purpose, the supreme court of Georgia holds states a sound legal proposition, and is not open to the criticism that it impliedly instructs the jury that a failure to perform such duty would be negligence per se (by itself).

PARK COMMISSIONERS CANNOT BE ENJOINED BY CITIZENS AND TAXPAYERS FROM PERMITTING CONSTRUCTION OF STREET RAILWAY.

Bancroft vs. Bancroft (Del. Ch.), 61 Atl. Rep. 689. Aug. 25, 1905.

A resident citizen and taxpayer of a city, the court of chancery of Delaware holds, is not entitled, as such citizen and taxpayer, to an injunction to restrain the board of park commissioners of the city from permitting a street railway company to construct its road through park land in alleged contravention of the terms of the conveyance to the city that it was to be for the sole use and purpose of a public park. The court says that it has not been able to find a single case in which the right of a taxpayer and citizen to bring such a suit as this merely as citizen and taxpayer has been sustained.

FRANCHISE FROM ONE MUNICIPALITY WHEN ANOTHER ENJOINED FROM ACTING PENDING SETTLEMENT OF ANNEXATION DISPUTE INVALID.

Little Rock Railway & Electric Co. vs. City of North Little Rock (Ark.), 88 S. W. Rep. 826. June 17, 1905.

In May, 1903, petitions were filed with the town council of the town of Little Rock, signed by a majority of the citizens of that town and a majority of the citizens of the Eighth Ward of the City of Little Rock, praying for the annextion of said ward to said town. An election in the affected territory was called for July 21st. The election was held, but by proceedings begun July 6th by the city of Little Rock, its mayor and aldermen and numerous citizens and corporations, including the street railway company, the declaration of the result was temporarily enjoined, and North Little Rock was enjoined from exercising any municipal function over said ward. Moreover, in June, after the election was ordered, and before it was held, the council of the city of Little Rock granted to the streef car company a franchise to build and maintain a street railway over certain streets in the Eighth Ward. The franchise ordinance, however, contained certain conditions, and on August 10th, the city council of Little Rock materially amended this ordinance, so as to take out the conditions which prevented it from becoming at once operative. After the passage of this ordinance, and before the injunction case was finally determined, the street car company began the construction of its line in the Eighth Ward, laid considerable track, and spent in all about $27,000 on the work, though it was not completed in any part or ready for operation when the decision in the injunction suit was rendered by the supreme court. The supreme court of Arkansas holds it inequitable to allow rights to be thus acquired, and that neither the city of Little Rock nor the street car company could hold rights acquired over the streets of the Eighth Ward during the life of the injunction. Nor does the court think that under the circumstances the case called for an estoppel against North Little Rock on account of its permitting the street car company to partially construct its lines over these streets, and expend about $27,000, without protest or resistance. It says that the decree in the court below allowed the street railway company 60 days to dispose of or remove the rails, cross-ties, and other material placed by it on the streets, and that was as favorable as it could ask on that score. But deciding that no rights could be sustained under the ordinance of August 10th, the supreme court says did not dispose of any rights which the street car company might have under the ordinance passed in June.

LIABILITY FOR INJURY DUE TO DEFECT IN HIGHWAY BRIDGE.

Wagner vs. Lehigh Traction Co. (Pa.), 61 Atl. Rep. 814. May 15, 1905.

Primarily, the supreme court of Pennsylvania says, it is the duty of township authorities to maintain a bridge, being part of a public highway, in a safe condition for the use of the traveling public. In order to sustain this action, which was to recover damages for injuries from a collision of an electric car with a wagon in which the plaintiffs were riding, alleged to be due to the company's negligence in maintaining its tracks over a bridge, the court says that it must be shown that it was the duty of the company to maintain the bridge, at the point where the accident occurred, in a safe condition. If on a trial of the case it appeared that no such duty rested on the company, but that the primary duty of the township to maintain the bridge at the point of accident still continued, the company would be relieved from liability.

STATUTE NOT CONFERRING IRREVOCABLE CONTRACT RIGHT TO IMMUNITY FROM LIABILITY FOR REPAVEMENT OR EXEMPTION TO LESSEE COMPANY —CONSIDERATION FOR GRANT OF EXEMPTION.

City of Rochester vs. Rochester Railway Co. (N. Y.), 74 N. E. Rep. 953. June 6, 1905.

A statute passed in 1869, referring to the defendant's predecessor, provided: "Said company shall put, keep and maintain the surface of the streets inside the rails of its track, in good and thorough repair, under the direction of the committee on streets and bridges of the common council of said city of Rochester; but whenever any of said streets are by ordinance or otherwise permanently improved, said company shall not be required to make any part or portion of such improvement, or bear any part of the expense thereof, but it shall make its rails in such street or streets conform to the grade thereof." This, the court of appeals of New York says, certainly did not exempt the company from any expense of repavement so long as the statute remained in force, but the question was, did the statute confer upon the company any contract right immune from subsequent recall, or was it the mere exercise by the legislature of the taxing power, which could at any time

be changed, modified or repealed? The court is of opinion, first, that the statute did not constitute a contract between the state and the railroad company; second, that if it did, the exemption granted by the statute was personal to the defendant's predecessor in title, and had not passed to it. It says that the statute did not grant the franchise. That had been already acquired. An exemption from taxation or regulation of charges granted by statute to be irrevocable must be based on a consideration. When a mere gratuity or privilege, it may be recalled at any time. When such exemptions are granted in the charter of a corporation, then the acceptance of the charter is assumed to be the consideration for the grant of the exemption. The true test of whether there was any consideration for the exemption granted by the statute is whether any acceptance of its terms and provisions was necessary to make it effectual. If not, how can it be said that the exemption is other than a privilege? Then, the court says that the language of the statute is personal, not attached to the property. It enacts that "said company," not "said company, its successors or assigns," shall not be required to bear any part of the expense of repaving the streets.

DUTY OF MOTORMAN SEEING CHILD NEAR TRACK—CONTRIBUTORY NEGLIGENCE OF PARENTS.

Jacksonville Electric Co. vs. Adams (Fla.), 39 So. Rep. 183. July 26, 1905.

Where the motorman of an electric car, being operated upon the streets of a city, should and must have seen a child of tender years, unattended, in dangerous proximity to the track upon which the car was being operated, it was his duty, the supreme court of Florida, division B. holds, to use means "strictly commensurate with the demands and exigencies of the occasion" to prevent injuring such child, the burden of proof being upon the electric car company to show that such means were used; and under such circumstances, if such proof is not satisfactorily made, the company is negligent and liable for damages. The contributory negligence of parents in permitting a child, a boy four years and one month old, to go without a caretaker upon the streets of a city upon which electric cars are operated, cannot be imputed to the child in an action by him against the corporation operating the electric cars for damages resulting to him from the negligent operation of an electric car.

VALIDITY OF ORDINANCE AGAINST ALLOWING WOMEN AND CHILDREN TO LEAVE OR ENTER MOVING CARS—DUTY OF CONDUCTORS.

McHugh vs. St. Louis Transit Co. (Mo.), 88 S. W. Rep. 853. June 28, 1905.

A city ordinance providing that "conductors shall not allow ladies or children to leave or enter the cars while the same are in motion," the supreme court of Missouri holds, is not unreasonable or void, nor does it impose upon public carriers of passengers an unreasonable duty toward those under their care and whom they undertake to carry safely. Moreover, the court says that where an instruction to the jury required of the conductor the exercise of reasonable care to prevent the plaintiff from alighting from the car while in motion, that was nothing more than his duty anyway, for it is common knowledge that it is dangerous for passengers to step from cars upon which they are traveling when such cars are in motion. No conductor who is regardful of his duties toward his passengers would neglect to exercise ordinary care to prevent injury to them while getting off or on the car of which he has control.

CARE REQUIRED OF STREET RAILWAYS AS COMMON CARRIERS—RELATION OF CARRIER AND PASSENGER CONTINUES UNTIL LATTER ALIGHTS—MUST HOLD CAR STATIONARY AND EXPECT IMPULSIVE EXITS—CONDUCTOR SHOULD LOOK TO CAR BEFORE GIVING SIGNAL TO START.

Nelson vs. Metropolitan Street Railway Co. (Mo. App.), 88 S. W. Rep. 1119. June 26, 1905.

Street railways, the Kansas City court of appeals says, are common carriers, and as such must employ the highest degree of care to avoid injury to their passengers. The relation of carrier and passenger continues to the time the latter alights from the train. It was not only the duty of the defendant to safely carry the plaintiff, but, when her destination was reached and the car stopped, to hold it stationary while she was alighting. The street car conductor has no means of knowing how many passengers intend to alight at a given place, and therefore cannot judge in advance of the length of stop required. Regard, also, must be had for the habits of people patronizing such urban vehicles, who frequently make impulsive exits therefrom for divers reasons. However long a stop may be, due care requires the conductor to look to his car before giving the signal to start.

CATCHING OF HEEL ON RUNNING BOARD NOT RES IPSA LOQUITUR.

Wilbur vs. Rhode Island Co. (R. I.), 61 Atl. Rep. 601. May 29, 1905.

The plaintiff contended that, as it appeared in the declaration that while alighting from the car the heel of her shoe was caught in the running board, whereby it was torn off, and she was thrown to the ground and injured, and that the car had always been in the exclusive possession of the defendant, and that she never saw it before nor after the time she was injured, and had had no opportunity to inspect it, and therefore did not and could not state the exact cause of the accident, therefore the case came within the class of cases to which the maxim "res ipsa loquitur" (the matter speaks for itself) applied. But the supreme court of Rhode Island holds that the fact that the plaintiff caught her shoe on the running board, and the heel of the shoe was torn off, and she was thrown. did not speak as to the negligence of the defendant. Proof of such fact would not raise a presumption of negligence, which it would be necessary for the defendant to rebut. It would be necessary for the plaintiff to go further, and show some circumstance attendant upon the accident of such a character as to justify the jury in inferring negligence as the cause of the accident.

DUTY TO PERSON RECEIVED AS PASSENGER ON SPECIAL CAR—WAIVER OF RIGHT TO INSIST ON ONE NOT BEING A PASSENGR.

McCarter vs. Greenville Traction Co. (S. C.), 51 S. E. Rep. 545. July 11, 1905.

It was contended that the circuit judge erred in charging the jury in this case as follows: "If a common carrier receives a person on its car, it thereby assumes towards that person all the duties incumbent on a common carrier, irrespective of whether the particular car happens to be a regular schedule car or a special car; the testimony having shown that the car that the plaintiff desired to ride upon was a special car, chartered by a particular person, and was run that night after regular schedule hours and for a particular purpose." But the supreme court of South Carolina affirms the judgment of the lower court for the plaintiff. It says that the defendant's answer showed that the plaintiff tendered the amount of his passage and kept his seat in the special car with the knowledge and consent of the conductor, who intended to transport him to his destination. The defendant, therefore, waived the right to insist upon the fact that he was not a passenger at the time when he claimed that he was afterwards wrongfully ejected for nonpayment of fare, the conductor not having been able to change a fifty-cent piece.

LIABILITY FOR JERK OF CAR WHILE A PASSENGER IS LEAVING OR CHANGING CARS—PLEADING AND PRESUMPTION OF NEGLIGENCE.

Georgia Railway & Electric Co. vs. Reeves (Ga.), 51 S. E. Rep. 610. Aug. 3, 1905.

If a car is at rest temporarily, and a passenger is lawfully leaving it, or passing from it to another car, under the direction of the conductor, and while this is in progress a sudden and violent jerk or movement of the car is caused by the company's agents, resulting in injury to the passenger, it is not necessary, the supreme court of Georgia holds, to allege in detail by what particular means they caused the jerk to occur. If a car containing passengers is stopped while in transit, and the passengers are directed by the conductor

to change to another car, which is on a track parallel to the first, and if, while they are so doing, the employes of the company put out the lights of the first car, and cause it to jerk suddenly, resulting in injury to a passenger who is in the act of making the change this would be an injury resulting from the running of the cars of the company, within the meaning of the statute, and would also be a damage done by a person in the employment and service of the company, so as to raise the statutory presumption of negligence against it.

DUTY TO PASSENGER ON RUNNING BOARD OF CROWDED CAR—BURDEN OF PROOF WHERE PASSENGER IS STRUCK BY ANOTHER CAR AT SWITCH—STANDING ALONGSIDE OF CAR NOT CONTRIBUTORY NEGLIGENCE AS MATTER OF LAW.

Abel vs. Northampton Traction Co. (Pa.), 61 Atl. Rep. 915. May 24, 1905.

As a crowded car approached a switch and siding it was struck about the middle of the side by a car coming from the opposite direction, which had not stopped on the turnout. The supreme court of Pennsylvania says of a man who was struck in the collision that if he was unable to find room upon the first-mentioned car, elsewhere than upon the running board, and if the company accepted him as a passenger in that position, and was undertaking to carry him, he was entitled to protection. If he was thus struck and injured by the other car, the burden of showing that the accident was not caused by the negligence of the motorman of the colliding car was certainly upon the company. But two witnesses testified that the man was standing alongside the first car when he was struck, and was not upon the running board; and the trial judge instructed the jury that the uncontradicted testimony of these two witnesses, if believed, clearly established contributory negligence. The supreme court, however, holds that in this statement there was error. It says that even if the man was standing upon the ground at the side of the car, this was not a place which the court could say as a matter of law was intrinsically dangerous. There was no reason why he should have apprehended that the other car would continue to run out from the siding and over the switch, and would strike with its front end the side of the first car. In any event it was not for the court to say as a matter of law that he was guilty of contributory negligence in assuming the position in which he was when struck by the car. Whether or not his conduct in this respect was negligent under the circumstances was for the jury to decide.

PLACE OF TAXATION OF PERSONAL PROPERTY.

Detroit, Ypsilanti, Ann Arbor & Jackson Railway vs. City of Detroit (Mich.), 104 N. W. Rep. 327. July 21, 1905.

Section 3831, subdivision 16, of the compiled laws of Michigan of 1897 provides that the "personal property of street railroad, * * * cable or electric railroad, * * * shall be assessed in the township, village or city where its principal business is situated. "The office for the transaction of the business of the complainant is required by its articles of association to be kept in the village of Dearborn. All of its officers and directors reside in Detroit. There its president, secretary, and treasurer each has an office, and there it may properly be inferred each of these officers does the business pertaining to his office. In Dearborn are kept the records of the official and other business of the company. There, as well as at Ypsilanti and Jackson, its conductors and motormen make reports. Furthermore, from the fact that the company did no banking at Dearborn, the supreme court of Michigan infers that the conductors did not, with these reports, account for the receipts collected by them. From the fact that the bookkeeper was in the office at Dearborn only about half of the time, and from the fact that nothing went on the books at Dearborn until it had passed through the Detroit office, it infers that there was no custom of the company to approve or disapprove these reports from the Dearborn office. Under these facts, was the company's property taxable at Dearborn or at Detroit? The court holds that the property was taxable in the city of Detroit, where its president, secretary, and treasurer had their offices, and where they did the duties pertaining thereto. It says that while it may be conceded that, if the company had principal business offices in each of several townships, cities, or villages, it might by designation in its articles of association elect in which of said cities or villages said property should be taxed, it is equally clear that such designation would be altogether ineffectual as an election unless it actually maintained a principal business office at the place designated.

EQUIPMENT TO BE RETURNED BY LESSEE TO SUBORDINATE COMPANIES.

Johnson vs. Lehigh Valley Traction Co. (U. S. C. C., Pa.), 138 Fed. Rep. 601. June 12, 1905.

A holding company which had purchased a majority or more of a number of street railway companies leased all of them to a traction company with the assent of the stockholders of the separate companies. By the terms of the lease the traction company agreed to expend $100,000 for improvements within two years and to make improvements so that at all times said roads, rolling stock, etc., should be of at least equal efficiency and value as at the date of the lease, and was required to return to each subordinate company at the termination of the lease for any reason the property in as good condition as same was at the date of the lease. The traction company, after a little more than two years, went into the hands of receivers. The United States circuit court, eastern district of Pennsylvania, holds that, under the lease, in case of cancelation or abandonment, a return of equipment to each subordinate company equal in value and efficiency to that which was received was required, and that excessive value of cars returned to one company could not be set off against a claim of another company for a return of cars of equal value and efficiency to it. In other words, the court holds that as to a claim for the original equipment, the companies were entitled to a return of specific cars, sufficient to make an equipment for each equal in value and efficiency to that which each transferred to the traction company under the lease; and, in case the specific property was not returned, it would seem that each company was entitled to an award out of the general fund in an amount which would enable them to equip their respective roads with cars equal in value and efficiency to those which were transferred under the lease.

INSPECTIONS MUST BE ACCORDING TO CIRCUMSTANCES—CARE IMPOSED BY USE OF ELECTRICITY.

Warren vs. City Electric Railway Co. (Mich.), 104 N. W. Rep. 613. Sep. 19, 1905.

The plaintiff, a lad of 11 years of age, was seriously injured by coming in contact with a live telephone wire, which lay upon the ground in a public street. The proof showed that the telephone wire received its dangerous current from a trolley span wire belonging to the defendant railway company, through its being pressed down upon said span wire by the limb of a tree, which was broken by a severe storm the previous evening, at a considerable distance from the point where the wire parted and fell, which was the place where the boy was injured. Action was brought against the telephone company and the railway company, and a verdict and judgment was returned against the latter; a verdict being directed in favor of the telephone company.

In affirming this judgment, the supreme court of Michigan states, among other things, that it could not say as matter of law that the inspection proved was reasonable and proper. That was a question for the jury, depending as it did upon the condition of the line and the nature of the danger to be feared. The frequency and care required in inspections depend much upon the character of the apparatus, or machinery, or other agent from which danger is to be feared, and as its destructiveness and danger is increased the duty of care increases. In other words, the degree of hazard attending the use of a dangerous article has a direct relation to the care which is requisite in its use. Electricity is to be classed with gunpowder, dynamite, and other treacherous and destructive agents, of whose dangerous qualities the court may take judicial notice, as well as of the fact that society recognizes them, and acts accordingly No prudent man handles these things with a low degree of caution.

This court finds it unnecessary to say, as some courts have said, that the use of electricity imposes the duty of the greater possible care. The circuit judge did not so charge, but contented himself

with saying that the duty requisite was such as ordinarily careful and prudent persons would exercise in dealing with electricity under similar circumstances. This was sufficiently favorable to the defendant, although it involved the idea, before expressed, that the nature of the hazard is an element in determining the question. The frequency and nature of the inspections required depend in a measure upon this. Again, the supreme court says that in this case the span wire was hot where it was not so intended to be. The telephone wire was pressed upon it when it was not so intended. The wire burned in two from the intense heat taken on from the span wire, and the ends fell. All of these were things to be anticipated and guarded against. If this was not done to the extent that a prudent man would do it, there was a failure of duty, which might be a concurring cause of the accident, making the defendant liable.

LIABILITY FOR ACTS OF SPECIAL POLICE OFFICERS—ASSAULT BY ONE.

Foster vs. Grand Rapids Railway Co. (Mich.), 104 N. W. Rep. 380. July 21, 1905.

The public authorities appointed certain deputy sheriffs, with the same powers and duties as they would exercise in any other place, though they were apparently paid by the railway company, and it was the duty and custom for them to preserve order in and around certain pleasure grounds, to arrest those engaged in violations of law, and to accompany the street cars from the grounds to the city, when there were indications that there were rough persons aboard liable to cause disturbance. The supreme court of Michigan says that when acting purely in their capacity as police officers, the company was not responsible for their acts. Only when the company, through its authorized agent, had employed or directed such police officers to act for it, did it become responsible. If one of these officers acted, in his alleged attack upon the plaintiff, solely in his capacity as an officer, and not by and under the direction of the conductor of the car, the defendant was not responsible for his act. When a disorderly person is arrested by a police officer, the presumption is that the officer is acting in official capacity, and not as an agent for the party who by law is required to pay him. Here, however, from the officer's own testimony, and as well from that of the conductor, there was no attempt or intention to arrest the plaintiff for a breach of the peace, but only to put him off the car for the nonpayment of his fare. The only reasonable conclusion from this testimony was that the conductor either expressly or impliedly called upon the officer to assist him in ejecting the plaintiff, and that the officer understood that to be a part of his duty. Under these circumstances, the officer did not, in his assault upon the plaintiff, represent the public, but the company. It was wholly immaterial whether any angry words were spoken before the officer interfered, or whether the conduct of the parties up to that time had been gentlemanly and quiet.

APPLICATION TO HAVE MODE OF CROSSING A RAILROAD DEFINED—MUST SHOW REQUISITE OF CONSENTS.

Mercer County Traction Co. vs. United New Jersey Railroad & Canal Co. (N. J.), 61 Atl. Rep. 461. June 19, 1905.

Upon application to the court of chancery under the act of March 22, 1895, to define the mode in which one railroad may cross another, the court of errors and appeals of New Jersey holds that it was incumbent upon the petitioner to show it had lawful power to construct its road. One of the steps to that end being an ordinance of the township committee granting permission to the petitioner to construct its road under the railroad act of April 21, 1896, it was incumbent upon the petitioner to show the jurisdiction of the township committee to pass such an ordinance. The written consent of frontage property owners required by the street railroad act of April 21, 1896, in order to confer jurisdiction upon the township committee for permission to construct its said line; and that municipal permission may be granted for the construction of the line of street railway for which application was made to the township committee.

Upon application to define the mode of crossing, under the act of March 22, 1895, it was shown to the court of chancery that the petitioning corporation had resolved upon the construction of its line on May 20, 1903; that on May 21, 1903, it had petitioned the township committee for permission to construct its said line; and that the ordinance granting said permission was on the same day introduced and passed upon its first reading. It further appeared that the signatures to the consent of the frontage property owners, filed with the township clerk, were all acknowledged prior to May 20, 1903. The court holds that these facts failed to show that the property owners had consented to the granting of permission to construct the line of railroad for which application was made to the township committee.

ABUTTER WITHOUT REMEDY FOR BUILDING OF EMBANKMENT OF FROM 6 TO 15 INCHES IN CONSTRUCTION OF STREET RAILWAY UNDER LOCATION SILENT AS TO GRADE—STATUTES CONSTRUED.

Laroe vs. Northampton Street Railway Co. (Mass.), 75 N. E. Rep. 255. Oct. 17, 1905.

This was an action of tort brought by an abutter on a public way against the street railway company for building an embankment on the way, some 6 to 15 inches in height, in the construction of its tracks. The damage was caused by turning surface water onto the plaintiff's land, and otherwise. He offered to show "that no grade was fixed in the location granted to the street railway company; that no grade was defined by the selectmen in the order of location or subsequent thereto; that such changing of grade in the process of construction was not made by an order or direction of the selectmen or superintendent of streets; that no authority for raising the embankment and raising the grade above the natural surface of the street had been given the street railway company, the location not having been given any grade lines, and the same not having been furnished before construction." He conceded "that the defendant had a location to construct a street railway under the statutes," and "that in the building of the embankment and the construction of the road the work was properly done as street railway construction." He owned the fee in that part of the way on which the embankment in question was constructed. Upon these facts a verdict was directed for the defendant company, and the supreme judicial court of Massachusetts, to which the case was reported, decided for judgment on the verdict.

Where the grade of a public way is altered by the grant of a location of a street railway, it is not altered, the court holds, "for the purpose of repairing such way," and for that reason no compensation is due under the statute which provides that an abutter shall have compensation when he has sustained damage by the raising or lowering of a public way, or other act done for the purpose of repairing such way. In such a case the grade of the public way is rightly altered under the authority given to grant locations to street railways. The result is that where the grade of a public way is altered in the location of a street railway, the abutter is without remedy.

As to what was said in Hewett vs. Canton (182 Mass. 220, 224, 65 N. E. 42) that, if the abutter in such a case has a remedy against the street railway, it is under what is now section 44 of chapter 112 of the Revised Laws, referring to the clause in effect making a street railway liable (among other things) for loss or injury sustained during construction which results from the carelessness of its servants, if notice is given and an action is begun, as provided in section 20 of chapter 51 of the Revised Laws; that is to say, as provided for actions brought to recover for defects in public ways. That section manifestly was enacted to relieve towns from liability for injuries to travelers in fact caused by the railway, and has no application in cases like this one.

But the plaintiff contended that under this location the grade of the way was not rightly altered, and for that reason he, as owner of the fee on which the embankment was constructed, could sue in tort for the wrongful construction of it on his land. He argued that, under a location which is silent as to the grade, the railway must be built at the grade in fact existing or lawfully established. The court is of opinion, however, that this contention was not correct, but that, on the contrary, as matter of construction of the location in question, the grade of the way might be changed within the limits in question, if that was reasonably necessary as matter of street railway construction.

The New Shops of the Portland Railroad Co.

The new shops of the Portland Railroad Co., at Portland, Maine, illustrate in a marked degree the present tendency toward higher production economy in street railway rolling stock maintenance. Of late years it has been more and more realized that the reduction of expenses is quite as important a factor in the securing of dividends as the increase of gross earnings. In the early days of street railway work the maintenance of the rolling stock seldom proceeded along economical lines. The problem of keeping the cars moving was so severe and the evolution of equipment so rapid that organized methods of repairing were largely out of the question. Although rolling stock design is still undergoing radical improvements, the general run of car equipment is now reasonably well standardized, sufficiently so at any rate for it to pay to maintain car bodies, trucks, motors and braking apparatus at high efficiency throughout a considerable term of years.

The repair shop problem is therefore a very important question on a modern system and the question whether all repairs should be carried out in one general shop or divided among smaller shops located in different sections of a city has received much discussion.

The shops occupy an area 204 ft. 8 in. long by 171 ft. wide, and serve the maintenance requirements for about 230 cars—the total rolling stock of the company. The repair shop area per car thus figures 152 sq. ft. A general plan of the new shops with approach tracks and their relation to the St. John St. car house is shown herewith. It will be seen that each department can be reached by a direct line from the ladder tracks which connect with the St. John St. tracks through a spur. The new shops are located 92 ft. south of the old car house and are supplied with steam heat from boilers located in the basement of the latter. The steam main is 10 in. in diameter and is supported in its 92-ft. span by a lattice riveted-steel box beam. The boiler plant consists of three 48-h. p. horizontal return-tubular units. These are operated at low pressure, from 1 to 10 lb. being the usual range, but in moderate weather it is only necessary to operate with the pressure gauge pointer just off the zero mark. The shop building was designed by Messrs. Sheaff and Jaastad of Boston, consulting engineers for the Portland Railroad Co.

The primary idea in the layout of the shops was to facilitate the

NEW REPAIR SHOPS OF THE PORTLAND RAILROAD CO.

The present idea favors the concentration of all except emergency repairs in one large shop, leaving the lighter work of inspection and temporary repairs to division headquarters and car houses.

This is the practice which has been followed at Portland in the erection and equipment of the new general repair shops to be described in this article. The shops are located on the east side of St. John St., Portland, about a quarter of a mile south of the Union Station, and adjacent to the St. John St. Car House of the system. A general view of the exterior is shown herewith. Behind the shops rises a hill, on which is located the famous Western Promenade of the Portland park system, from which, on a clear day the White Mountains can easily be seen. The main line of the Boston and Maine R. R. passes the shops a few rods away on the west. The St. John St. shops are designed to take care of all the regular maintenance work of the company with the exception of daily inspection and temporary repairs, which are carried out at six car houses on the system. The walls of the new building are of brick with concrete foundations, steel trusses and columns being used for supporting the roof. Every effort was taken to render the shops fire proof. The various departments are separated by brick fire walls 16 in. thick, with self-closing, tinned doors, the division walls being carried at least 24 in. above the roof. The one-story sections are equipped with granolithic floors; on the second floor slow burning wooden construction was used, faced with 7/8 in. birch.

handling of cars and material over routes of minimum length between departments, and to arrange the departments conveniently. From the general plan it will be seen that this has been accomplished. On the first floor are located the office of the master mechanic, the equipping, paint, carpenter, blacksmith and machine shops, and the foundry. Above the machine shop is an upholstery room and an armature winding and electrical department, while above the office is a storage space and possible stock room. The carpenter shop is equipped with a single track; the equipping shop has two full length tracks, one of which passes through to the rear of the blacksmith shop. The paint shop has three tracks. Each track is supplied with an overhead trolley, but at fire doors the trolley is discontinued on each side of the wall. On account of the directness of the track runs the idle moment of rolling stock and material is very small, and these facilities are supplemented by an admirable system of chain hoists. Between the blacksmith shop and the machine shop a 2-ton hoist is installed to run longitudinally from the extreme end of one department to the extreme end of the other, in a line at right angles to the car track in the blacksmith shop floor. The girder forming the runway for this hoist can be seen in the accompanying view of the blacksmith shop interior. This connection with the machine shop enables any part of the shops to be reached with ease in the handling of heavy pieces, and in addition, large doors are liberally provided between the building and out-of-doors. The runway be-

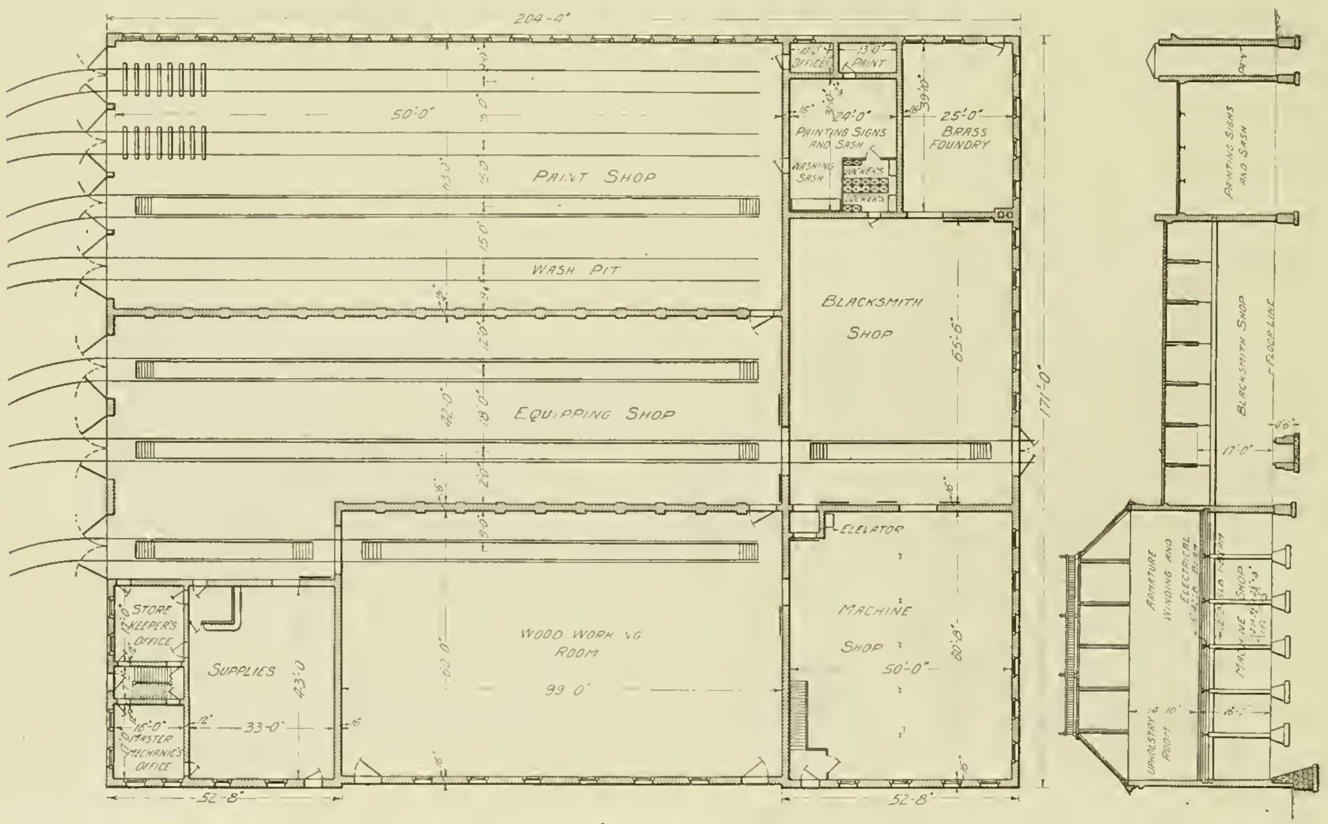
tween the blacksmith and machine shops is carried through the fire doors between these two departments, the doors being cut away just enough to allow the girder to pass.

Between the machine shop and the electrical department on the second floor the transportation facilities are provided by a Morse-Williams electric elevator driven by a 10-h. p. 500-volt shunt motor. The elevator well is 7 ft. by 5 ft. in horizontal cross section, and is set in the building so that the blacksmith shop as well as the machine shop is served by it. Tinned doors are provided. On the upper floor armatures and other parts are carried about by trucks. There is no doubt that these excellent transportation facilities will prove important factors in the economical operation of the shops, tending to reduce the unit cost of repairs through the saving in labor and time which they bring about.

The carpenter shop is 99 ft. long by 60 ft. wide. It is steam heated by open coils arranged in sections along the walls, and is lighted by three overhead skylights, by ample windows on the west side and at current supply is temporarily cut off from the shops the automatic release opens the motor circuit and stops the machinery until the line potential returns, when it automatically starts the motor, cutting out resistance gradually as the motor speeds up, until the machinery is again operating at full speed.

The shafting in the carpenter shop is hung from wooden stringers which in turn are fastened to the girders of the roof trusses. Along the west side of the carpenter shop a bench is run beneath the windows, for work requiring varnishing, planing and chiselling.

All the departments are equipped with an automatic sprinkling system. The water supply for this system is stored in a 10,000 gallon wooden tank supported on a steel tower just south of the old St John St. car house, between the new building and the old. The sprinkler installation is very complete. The buildings are also protected by hand fire extinguishers, a special fire alarm box and numerous hydrants in the yards. The departments of both the car house and shops are connected by an inter-communicating telephone system



FLOOR PLAN OF PORTLAND RAILROAD CO'S SHOP BUILDING AND CROSS SECTION AT REAR END.

night by four enclosed arc lamps and incandescents arranged on the series system with 500-volt circuits. The trolley over the single track which serves this room is protected from contact with the steel trusses by a wooden trough and the track is provided with a pit. The walls are painted a light yellow with a dark green dado extending about 5 ft. above the floor. Between the track and the wall nearest it a row of 16-c. p. incandescent lamps is hung, one from each truss, 9 ft. apart. These lamps are of much help in lighting the carpenter shop passageway and the sides of the cars next the division wall. The lighting circuits in the room are controlled by switches mounted on a wooden panel covered with asbestos. This panel is mounted upon the wall at the north entrance of the room.

The machinery in the carpenter shop is all driven on the group plan by a 30-h. p. G. E. 500-volt shunt motor making 1025 r. p. m. At present this motor drives a circular and split saw bench, jointer, band saw, cutting-off saw, grindstone, mortising and basing machine, shaper or irregular moulding machine, Woods planer, planer and a small speed lathe which was made by the Portland Railroad Co. The motor is operated by a starting panel of black enamelled slate supporting a 100-ampere current indicator, double-pole single-throw knife switch, two 600-volt 60-ampere Chase-Shawmut enclosed fuses and an automatic starting and release switch. In case the of ten stations. From these instruments connection may be had with any city telephone.

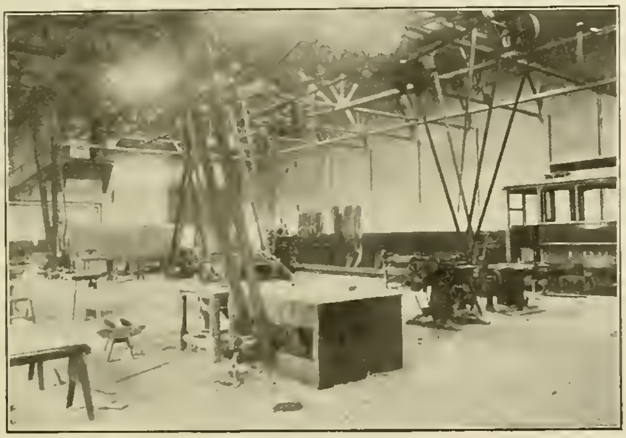
One of the noticeable points in the arrangement of the shops is the unusually plentiful supply of natural light in all parts of the buildings. Both in sky and side lighting liberal facilities were provided. Another noticeable feature is the liberal amount of space in each department, both for present needs and growth in the future.

The machine shop is 60 ft. 8 in. long by 50 ft. wide. At present it is not completely fitted up. but contains a 125-ton hydraulic wheel press, 24-in. engine lathe, 21-in. engine lathe, one milling machine, 36-in. upright drill and a 9-ft. bed planer. A 36-in. boring machine is soon to be added. These machines are group-driven by a 15-h. p. 500-volt motor mounted upon the floor near the carpenter shop wall and equipped with an automatic release and solenoidal starter. The machine shop is lighted by south and west windows, and at night by 16-c. p. incandescent lamps, and two enclosed arc lamps. The 2-ton hoist previously mentioned is of much help in handling work in this room.

The blacksmith shop is 65 ft. 6 in. by 50 ft. in size, and is very complete and roomy. It is equipped with three large forges ventilated by galvanized iron hoods and discharge pipes, a screw machine, 28-in. drill press, a power hammer, driven by line shafts operated by a 10-h. p. 500-volt 4-pole shunt motor making 1,500 r. p. m. This motor

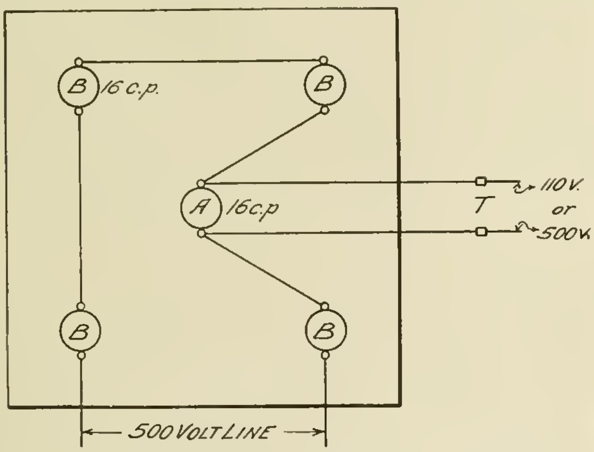
can be run closed if desired, its capacity then being 6 h. p. The air blast for the forges is supplied through a duct located beneath the floor. A 25-h. p. 500-volt motor direct connected to a fan blower furnishes air pressure.

The blacksmith shop is lighted by three enclosed arc lamps and by incandescents. It is equipped with steam heat and sprinklers. The blacksmith shop track is provided with a pit extending practically its entire length. The motor which drives the several tools is mounted upon a raised platform in one corner of the room to protect and keep it out of the way. Part of the wall space is utilized by a rack which holds different grades of bar iron, and on the south side below the windows is a work bench. The floor is of wood, which is less troublesome than concrete when scored and cut by heavy pieces of metal. The longitudinal runway previously mentioned passes overhead in front of the three forges, so that truck parts or other equipment can be readily transferred from the entering track to any forge, or to the drill.



WOOD-WORKING SHOP.

The equipping shop is 150 ft. long and 42 ft. wide. It has a bay at the north end about 60 ft. wide. There are two tracks in this department, spaced 18 ft. apart on centre lines, besides a track through the bay to the carpenter shop. The two tracks which run all the way through the equipping shop each have pits, the bottoms being concrete and the sides brick—the usual construction in these shops. The floor is of concrete, and the natural lighting is chiefly effected through the skylights. Plug sockets are available, however, so that the lamps may be carried anywhere beneath the cars when desired. This department is equipped with four 4-ton hand hoists on travellers arranged to sweep the entire area. The travellers are suspended from wheels which run on longitudinal girders used as runways. By means of these a car body can be hoisted from the trucks without the use of jacks and moved to any desired portion of the room.

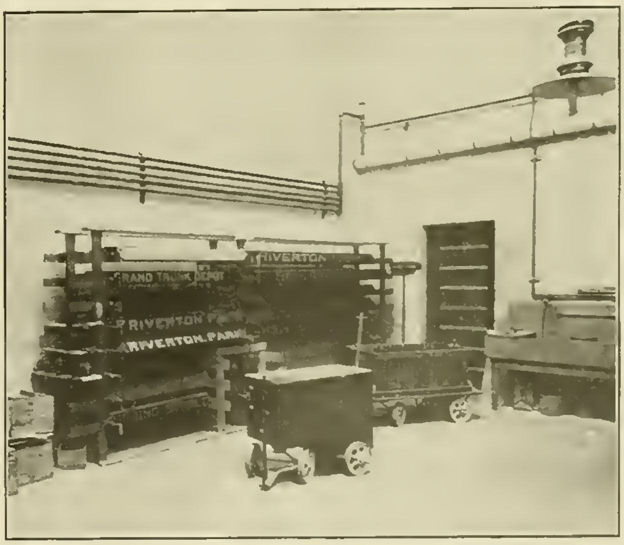


CONNECTIONS FOR OBTAINING TWO VOLTAGES BY THE USE OF LAMPS.
WITH "A" UNSCREWED. 500 VOLTS AT "T."
WITH "A" SCREWED IN. 110 VOLTS AT "T."

In the southeast corner of the building is a room 39 ft. 10 in. by 25 ft., set apart as a brass foundry. At present the principal work done here is babbitting, but some brazing is also done. Three Ridlon babbitting devices are in use. The work done by these is sufficiently accurate so that the reboring process in the case of axle bearings is not necessary; but motor bearings are rebored in the machine shop. The brazier is equipped with a large galvanized iron hood leading upward to the roof through a ventilating pipe. This was made necessary by the action of the brazier on the sprinkler system. When the process of brazing was first tried, the hot air rising from the apparatus started the sprinklers, so it became essential to protect the latter by a shielding funnel and discharge pipe.

BLACKSMITH SHOP AND TOOLS.

The paint shop is 150 ft. long and 63 ft. wide. It is provided with four tracks spaced 15 ft. apart on centres. One of these tracks is provided with a washing pit, and another with a repair or inspection pit. In this shop it is planned to paint each car at least once a year. The supply of daylight is plentiful, coming from both east windows and skylights fitted with ribbed glass. The floor is of concrete. Car steps are painted by dipping them bodily into a trough of black varnish—a process which saves a large amount of time and labor in intricate step patterns. Extra troughs are provided for dripping purposes, after the steps have been dipped in the black varnish trough. To obviate the raising of dust, brushes fitted with kerosene oil reservoirs are used. The oil moistens the bristles slightly when the brush is used, keeping them damp and tending toward the absorption instead of the scattering of dust. At the south end of the paint shop are three rooms. One is used as an office for the head of the department. This room is 10 ft. long by 7 ft. wide. The second is a sign and sash room 31 ft. 10 in. by 34 ft., and the third is a fire proof room 13 ft. by 7 ft. used for the storage of paints and oils.



SIGN AND SASH ROOM OF THE PAINTING DEPARTMENT.

The sign and sash room has several special features. It is lighted by a single enclosed arc lamp, and also, in the daytime by a skylight. In one corner is a sign storage rack of special design, shown in the illustration. This rack is built to hold both end and side signs, and is unusually compact. It occupies a space only 16 ft. long, 32 in. wide, and 7 ft. high and holds no less than 64 signs, long and short, or enough for 16 cars. The storage of signs is often a troublesome matter in street railway shops and in this instance it seems to be accomplished with a minimum of trouble. In this room adjustable racks are provided for the storage of window sashes, and on one side a complete sink equipment with steam and cold water is installed. This sink is wide enough and long enough to enable car doors to be laid in it for washing. The two small trucks shown in the photograph are interesting labor saving devices. They were designed by Mr. H. S. Hovey, the head of the painting department.

The truck nearer the centre of the photograph is equipped with a number of drawers holding paint and other supplies, including in one compartment, a paint press. More than enough paint and necessary appurtenances required to paint an entire car can be carried in this wagon to any point in the shop. This results in the saving of a large amount of walking between the job and the stock room. The other truck is designed to hold all the window sashes used in the largest car of the system. The car is equipped with an extension rack to fit different sized windows. It is built strongly enough to hold up and transport about the shop a weight of 2,000 lbs.

The paint storage room has a high concrete threshold and an air-tight door. The walls are carried up to a point 4 ft. above the roof, the top being capped by a skylight. In the event of a fire it is expected that the room would become a chimney and there would in all probability be no chance for the flames to spread.

The winding department is at present equipped with one banding machine, one field coil winding machine, and one 22½-in. engine lathe, all driven by belt and line shaft from a 5-h. p. motor making 1,800 r. p. m. The motor is fitted with a 10-ampere meter, and a 1-ton hoist is provided to facilitate handling material to and from the lathe. A steam drying oven for armature and field coils will probably be installed in the near future. The upholstery room is not as yet equipped. The horses used in moving the armatures are fitted with wheels, and special hand barrows are also employed. Insulation tests are made by a 110-volt circuit and by a 500-volt circuit, the conections being changed from one to the other by the simple unscrewing of an incandescent lamp bulb as shown in the accompanying sketch. This method was devised by Mr. B. F. Cary of the electrical department.

About 45 men are now employed at the St. John St. shops. Power is supplied entirely by the 500-volt trolley circuit of the company. The master mechanic is Mr. C. P. Garland and the general manager of the company is Mr. E. A. Newman.

The American Street and Interurban Railway Association.

Being Its History, Purpose and Work as Described by Messrs. Ely, Swenson and Rugg, at the 182nd Meeting of the Massachusetts Street Railway Association.

The Massachusetts Street Railway Association held its 182nd consecutive meeting on Dec. 13, 1905. This meeting was held in Young's Hotel, Boston, Mass., and occurred on the 23rd anniversary of the organization of the American Street Railway Association, which took place in Young's Hotel, Wednesday, Dec. 13, 1882. It was a remarkable coincidence that the day of the month, the day of the week, the location and even the hotel should have been the same.

The guests of honor were Hon. W. Caryl Ely, of Buffalo, president, and Bernard V. Swenson, of New York City, secretary-treasurer, of the American Street & Interurban Railway Association.

President Ely addressed the association on the general history of the American Street & Interurban Railway Association, and the reasons for the reorganization. Mr. Swenson spoke on the subject of the work of the association now under way and the plans for the future. Both of these addresses are herewith given in part.

The meeting was preceded by the usual banquet, after which Hon. E. P. Shaw, president of the association, made a few introductory remarks. He then asked J. E. Rugg, superintendent of transportation of the Boston Elevated Railway Co., to give an account of the first meeting.

Mr. Rugg, who in 1882 was superintendent of the Highland Street Railway Co., was instrumental in organizing the association. He gave some interesting reminiscences of the early days of the association.

Mr. Rugg's Remarks.

Twenty-five years ago tonight the first banquet of the American Street Railway Association was held, and twenty-three years ago today the constitution and by-laws of the association were adopted. It was a small beginning. I suppose you are somewhat familiar with what caused or brought about this association, but perhaps it would not be out of place for me to say in a few words what I know about it. In the autumn of 1882, in September, a self-appointed committee of three (of which I was one) arranged for a vacation trip to go through some of the Western States and meet our friends in the street railway business. We went to Buffalo, where we met Henry M. Watson and S. S. Spaulding. We also stopped at Cleveland, Chicago, Louisville and Cincinnati, but there was no real object in our visit, except pleasure and association. The association was found to be pleasant, as we were all engaged in the same business, and after we got back it was arranged through correspondence that there should be an attempt made to form an organization. Mr. Littell, of Louisville, issued a circular over his own name to all the street railway companies in the country, asking them, if they favored the project, to communicate with myself in Boston.

As soon as the circular was sent out there was quite a general response. Acklowledgments were received from perhaps a hundred gentlemen, managers of street railways from Montreal to New Orleans and a very large proportion favored the scheme. There were only perhaps six out of all to whom letters were sent who did not favor it. It was decided that I should issue a call for a convention to be held at Young's Hotel on Dec. 12, 1882.

That was the beginning, and you know what the result has been. The association has been growing; it has met the approval of street railway managers generally throughout the country, and today it is a strong body, officered by very strong and able men.

Mr. Ely was then called upon by the president, and spoke as follows:

Address of President Ely.

I was greatly pleased to receive your invitation to be present here tonight, because it gave me an opportunity, in the first place, of meeting you all; in the second place, to observe your association and its membership; and in the third place, to say something concerning the American association, concerning which much has been done in the last two or three years, but about which something may yet remain to be explained and made clear to the satisfaction of all. It seems from an examination of the papers that the two documents upon which the organization was founded were a letter which was in the form of a call signed by Mr. H. H. Littell, at that time superintendent of the Louisville City Railroad Co., and the acceptance, which was signed by Mr. Rugg, in fixing the date, in his capacity as superintendent of one of the Boston railroads.

Among those actively associated with Mr. Littell in the fundamental work of the organization were Mr. Rugg, Messrs. D. F. Longstreet, Thomas Lowry, Walter A. Jones, George B. Kierper, Henry N. Watson and Tom L. Johnson. In response to the call which was issued by Mr. Littell and the subsequent letter of Mr. Rugg, the meeting was held at this hotel on December 12th. It was called to order by Mr. Littell, and the Hon. Moody Merrill, presi-

dent of the Highland Street Railway Co. of Boston, was elected chairman. Messrs. Woodworth of Rochester and Clegg of Dayton, O., were chosen as secretaries. On the following day, the constitution and by-laws were adopted, and on that day, Dec. 13th, the first meeting of the association was held.

Coming to the objects of the association, they were defined in the constitution and by-laws as follows: "The acquisition of experimental, statistical, and scientific knowledge relating to the construction and operation of street railways, and the diffusion of this knowledge among the members of the association, with the view of increasing the accommodation of passengers, improving the service and reducing the cost; the establishment and maintenance of a spirit of fraternity among the members of the association by social intercourse and encouragement of cordial friendly relations between the roads and the public." With the exception of the work of the special committees and the work of the secretary incidental to the printing and distribution of the proceedings, the entire work of the organization was performed at the annual conventions. In the early days of the association, a good deal of important work was done by the special committees, but as time went on the special committees became fewer in number, and the work accomplished by them (except in certain noteworthy instances, which constituted marked exceptions) grew less and less, and in the last few years very little of that work was done. So that, aside from the work done at the conventions and the work which was performed by the secretary and treasurer in collecting dues and assigning space to the manufacturers for their exhibits at the annual meetings, there was very little work done by the organization itself.

The association started with 31 members, grew in three years to a membership of 123, and by 1892 the membership had increased to 201. In 1893, 1894, 1895 there were times of financial stress, and there was for some reason a lack of interest in the association, and the membership fell off until in 1895 and 1896 very heroic measures were taken to rescue the association from what appeared to be danger of failure. From that time, within a few years after 1895, there was a considerable increase in membership, up to about 200 members, and with some slight variation the membership has been held at about that figure down to the present time.

During the past ten years of the association the duties of secretary and treasurer and the performance of the work that was associated therewith have been very faithfully administered by Mr. Thomas C. Penington, treasurer of the Chicago City Railway, and the financial condition of the association has been good.

About the year 1893, the exhibit of the manufacturers of mechanical appliances pertaining to the business, which for some time had been assuming form, became the distinctive feature of the annual assemblages. This exhibit grew in size until finally it became one of the most important features of the annual meeting. It became of great importance to the association for the further reason that the practice grew up of permitting the association to allot to the manufacturers space for their exhibits in the exhibit hall, and to charge the manufacturers for that privilege. From that practice came quite a large part of the financial support of the association.

The dues which were paid by the companies for membership in the association were small, and the financial support was derived, as you have seen, largely from the sale of space in the exhibit hall to the manufacturers and from the amounts contributed by the local companies toward the annual expenses of the convention. In the meantime there had been organized, some eight years ago, an association of street railway accountants, known as the Street Railway Accountants' Association of America. That association had members largely composed of the auditors of the various companies throughout the country, and it devolved upon the different companies some additional expense, and the loss of the time of those who attended those conventions, for a period, during each year. Soon after there came other subsidiary associations. Two of them being formed and others in sight, that matter assumed a phase that was very important to the companies. This association had arrived at the point where it had its own expenses to pay; it had the subsidiary organizations and associations to care for, and it became apparent to those who had been engaged actively in carrying on the organization, and who had happened to be placed in those positions by reason of election (possibly not of their own seeking) at the convention from year to year, that something had to be done about reforming the method of work, and of financing the organization, or the association might possibly find it necessary to discontinue the greater part of its work, or possibly be abandoned.

At that juncture it was decided to hold the convention at Saratoga Springs, and that the association should at that meeting hold its expenses down to the lowest notch, and defray all of the expenses except such portion as might be derived from the manufacturers. That was the last convention at which the association made any charge for the space allotted to the manufacturers' exhibit. At that convention the question of reformation, reorganization, change in the lines of work and method of carrying on the work of the organization was very exhaustively canvassed, considered and agitated; and it was determined that it would be better, more dignified, more conducive to the attainment of proper results, if the manufacturers should be formed into an association whose duties and objects it should be to install and defray all the expenses of the annual exhibit and to divorce that source of revenue from the association and leave the association to care for itself and stand upon its own bottom in a dignified and proper way. That decision was arrived at as the common judgment and opinion of those who were present, upon consultation with many important men who were absent from the convention.

It happened that at that juncture I was chosen president of the association. I assure you that instead of having been voluntarily instrumental in this matter, it came upon me like a thief in the dark, and I was pressed into a service that has taken a great deal of time, and of the magnitude of which I had absolutely no conception at that time. It is no fad of mine; it is no fad of the men who have composed the executive committees during the last three years. An immense amount of painstaking and self-sacrificing work has been done by those gentlemen throughout the year, for the purpose of endeavoring to put the association where it belongs, in the first position among the technical societies of this country and of the world.

These gentlemen at Saratoga who took charge of the movement for the organization of a manufacturers' association worked hand in hand and shoulder to shoulder with the officers of the American Street Railway Association, and builded so well that the exhibit which has just been held at the Philadelphia convention deserved to rank almost as an exposition. Then came the meeting at Philadelphia, at which the measures which have been going on during almost three years culminated in the adoption of a new form of constitution and by-laws for the association. There was as little a departure from the old form as was possible to make and provide a new method for the prosecution of the work. It is hoped and believed that if all shall work together in the new organization, instead of the steady-by-jerks method of procedure which was afforded by simply meeting together once a year and then dispersing and practically letting the whole thing drop until the convention of the following year, work upon the problems that confront the street railway industry and its foremost members will be prosecuted intelligently, coherently, in a centrally-directed way, throughout the year by the meeting of the convention and its committees, the secretary's office with an incumbent and proper assistants, and then such other instrumentalities as will be afforded by the subsidiary organizations, which will preserve their autonomy, but will be controlled and work under the direction of the central body. This brief resumé brings us to the work as completed at the Philadelphia convention. Since that time, the secretary who was chosen, Professor Bernard V. Swenson, has entered upon the discharge of his duties. An office has been secured at No. 60 Wall Street, in New York City, and the headquarters of the association has been opened there.

The secretary, like the officers of the association, did not seek his job. The job sought the man, and his qualifications were the sole factor that brought about his appointment by the executive committee, which looked earnestly and with splendid advisers through the field, in its choice of secretary and treasurer. It is not my purpose to speak at this time of Professor Swenson and his qualifications, but I may say (and perhaps I ought to say) that in the judgment of all those who had anything to do with the election and appointment, he is a man admirably qualified for the work, and I know I may say, from what I have seen of him, that he is a man whose work is in his heart and whose heart is in his work.

Now we are face to face with the future. The expenses of the

association from now on, if the work is prosecuted in the most careful and economical manner, will crowd the sum of $20,000. The fixing of the fees to be paid for membership in the organization was a branch of the work that occupied the attention of the executive committee for a considerable time, and upon which we sought the advice of different ones throughout the country. The scale of annual dues given in the new constitution and by-laws will provide sufficient moneys, if carefully handled, to defray our expenses, the expenses of the annual banquet being met by those who attend the banquet, which has been considered proper should be done. As the association was previously carried on, $25 a year was paid by each company and in exchange for that $25 the association gave out two banquet tickets, which, at $8 or $10 a head (as was the charge at certain banquets), almost consumed the entire amount of the fee that the company paid for membership.

There are two classes of membership provided for: the regular membership and associate membership. Any one interested in the street railway industry may become an associate member of the organization, receive its publications and all the benefits, except the privilege of taking part in the discussions upon the floor of the convention and voting therein, for the small sum of $5 a year, and it is the hope of the executive committee that during the next year at least 1,000 associate members will be secured.

The American association has in its membership throughout the United States, Canada, Mexico and even Porto Rico, questions which affect us purely through our state legislation; purely state matters, will of course be best handled in the future as in the past by the state organizations.

I feel that I would not be doing my duty at this time if I should fail to congratulate this, the Massachusetts, association upon the fact that in the years of its being since 1888, seventeen years, it should have been able to hold as many as 182 separate meetings. Now, while the work in Massachusetts, in New England, New York, Pennsylvania, Ohio, Indiana and the other states, which is peculiarly state work, may be best done, undoubtedly by the state organizations, still it seems manifest that much can be done by the American association in the way of acting in a measure in concert with the different state organizations, toward bringing into the different localities the benefits which obtain in others, and minimizing in each locality the injurious things that obtain. It is a fact that in looking at the street railway law and its administration in the different stages of this country, one is struck very forcibly by the fact that if there had been co-operation among the street railway men in the different parts of the country, there might have been a far greater uniformity not only of the statute law, but of the municipal law fixing the rights of the companies in franchises and all sorts of municipal and state legislation.

The American association, it is hoped, through a properly chosen committee upon state and municipal legislation, may still be able to do much to remedy these things and to iron out these irregularities and these inconveniences that are surely present. When you come to think of it, gentlemen, this whole thing is yet in a formative state. There is no organization in this country so strong or so powerful that it can afford to stand alone, when in the same business there are many other organizations administered by capable and able men. In co-operation there is strength; everybody knows it; everybody practices it.

The American Street & Interurban Railway Association and the industries which it represents today, has invested in it billions of dollars of capital. Hundreds of thousands of men are employed, and the operations of the business touch the daily life, comfort, convenience, and necessity of all classes of citizens. To society and the law we owe duties, and to us society and the law owe duties. We are entitled in all parts of this country to fair treatment and just treatment. The best way to obtain it is to have a strong organization that is supported by a large membership, and that continuously through its organization and its method of work devotes an intelligent attention to all the problems of the day that confront the business. Mention has been made of some of the more important problems that confront us at this juncture, and in the course of my remarks at Philadelphia I mentioned the agitation in favor of municipal ownership that, at that time had been making such progress in this country. Certain well-meaning but misguided representatives of the press seemed to have taken the idea that the principal object of our organization was to combat the principle of municipal ownership. No such position as that was assumed at Philadelphia, and no such position was advocated there.

I took occasion to point out certain facts that it seemed to those who had been consulted concerning the matter deserved investigation at the hands of this association, to the end that the truth might be known concerning the matter. It was not hinted at as the duty of this association to enter into an academic discussion with any man, or any set of men, concerning the principles of socialism, but it was suggested that we might very properly look into the facts which lie at the base of the proposition that municipal ownership of street railways in the municipalities of this country will be beneficial to all the citizens of the municipalities.

The principal thing that is alluded to specially as a reason why municipal ownership of street railways in this country would be advantageous to the people is the statement that it works well in England, where it has been tried, and in other parts of Europe. Now, there are those who have made some imperfect investigations concerning the working of municipal ownership in the cities of Great Britain and Europe who hold an entirely different view as to fact, and hold and entertain the opinion, and stand ready to justify it with facts and figures, that municipal ownership of public utilities is not working well in Europe. They further adhere to the opinion that even though it is working well there and that fact could be established, that the conditions are so very different as to the communities involved and the service afforded, that it might not work so well here, even though it may be working well there. Whatever investigation has been made has, as I suggested, been very imperfect. There has never been prosecuted any inquiry in which those having a special knowledge of the business of conducting street railways have taken part. It was suggested that we might well devote some time to those facts to the end that the truth should be ascertained.

I believe that it is for us to take some measures at this time to ascertain the facts, to the end that if we do no more we will contribute those facts to the discussion that is up. Since the Philadelphia convention, in many municipalities in this country the question of the public ownership of the public utilities in the different states has been made the principal topic and the principal issue in municipal elections.

The National Civic Federation in the United States has recently appointed a committee to make an investigation into municipal ownership, both in this country and Europe, and in making that investigation to go into everything affecting it, the social conditions, financial conditions, and everything that affects the case, both here and there, to the end that the Civic Federation may inform itself upon the merits of the case and take whatever action it may deem desirable or best. Within the last few weeks there have been some conferences on our part with some of the sub-committee of the Civic Federation, looking to some kind of co-operative effort on our part to work in connection with that investigation. It is believed that in some way this could be done, so that we would in a proper manner be represented in or about the investigation, which might be pregnant with great results, either of benefit or of injury to our business. That is about the situation, so far as any action or contemplated action on our part, touching the question of municipal ownership.

There are other questions of great importance affecting our business which it would seem ought to be carefully considered from year to year by this association, and it is not only upon technical matters but upon these broad problems of the day that the work of this association should be exerted. Concerning the question of statutory law, and the possibility of effort from one part of the country being judiciously exerted in another part of the country, let me say that within the last three days there has come into the secretary's office in New York an inquiry from a very large street railway company concerning certain legislation that is proposed in a neighboring state. The inquiry will call upon the secretary's office for considerable work and considerable information concerning the status of statutory grants in this country. I undertake to say that there are large financial interests in the city of Boston that would have been very materially assisted in their investments in street railway properties outside of this state, if there had been uniformity of the laws regulating such corporations and granting them their rights. There are states where it is impossible to obtain for an interurban railroad, no matter how greatly the public need may

demand it, a franchise for a longer term than 20 or 25 years. While that is not the condition in Massachusetts, or perhaps in any New England state, there are other things that are present in this section of the country not present in those sections, and things of benefit present there that perhaps may not be present here. Co-operation and intelligent investigation in the work must, it seems, be of great benefit to all of us.

I have said that which I came to say; I do not wish unduly to detain you. The new form of organization is afloat; it must be supported, or it will fail. Its officers have entered upon the work of the year with a pledge to you and to themselves that they will do their duty to the uttermost and as best they may; but we may have a secretary's office in New York; it may be well equipped, and it may stay there until doomsday, but it will be of no avail unless it has your hearty support. The officers of the association, unaided by a large membership that works hard and earnestly throughout the year, can do hardly anything. If we are to have the benefits which should come from this organization, all along the line, we will only attain them by hard, united work and effort by the members of the street railway fraternity in New England, the Massachusetts association and the New England club, and every form of united and co-operative as well as individual work. I thank you for your attention, and I trust that we will surely receive the support of all who are here, and that the association will receive the earnest support of your association and its members.

At the conclusion of Mr. Ely's address, Mr. Swenson was called upon.

Secretary Swenson's Address.

With the close of the Philadelphia convention, the work of the reorganized association began, and it now becomes my pleasure to say a few words as to what the association is doing and what its plans are for the future.

As the name implies, the American Street & Interurban Railway Association is international in character, its membership comprising not only street and interurban railway companies in the United States, Canada and Mexico, but also companies which are operating such railways in the island possessions of our country. The word electric does not appear in the title of the association, as it is an association of a certain general class of railways, irrespective of the means of motive power. The terms "Street" and "Interurban" have been considered as covering most comprehensively these classes of railways. The term "Street" refers to railways in cities, irrespective of whether they are operated directly on the public highway, on an elevated structure, or in a subway.

The term "Interurban," as applied to railways operating between cities, is quite specific in its usage and relates to the lighter type of railways which are now in general operated by means of electric power. The suburban roads of a city are so closely interrelated with the city and interurban lines that they are usually a part of one or the other of these systems, so that it was not considered necessary to designate them separately.

The first object of the association, as stated in the constitution, is "The discussion and recommendation of methods of construction, management and operation of street and interurban railways, and of safeguarding the interests of the same."

The second object is, "The establishment and maintenance of a spirit of co-operation among the members, and the encouragement of friendly relations between the companies and the public."

The third object is, "The acquisition of experimental, statistical and scientific knowledge relating to the construction, equipment and operation of street and interurban railways, and the diffusion of this knowledge among the members."

The membership in the association consists of two classes. The active members are the American street and interurban railway companies, or lessees, or individual owners of street and interurban railways. The associate membership consists of individuals, co-partnerships and corporations, who are actively identified with street and interurban railway interests, and other persons who in the opinion of the executive committee have had experience of such a nature as to render desirable their connection with the association.

The active members must necessarily be considered as primarily constituting the association. It was for the mutual interests and advantages of the street railway companies that the American Street Railway Association was formed, and it was primarily for the interests of the American street and interurban railways that the association was re-organized in September of the present year.

The associate membership permits of a certain class of individuals, co-partnerships and corporations to become connected with the association. This is highly desirable, as there are many instances in which connections of great value to the association and to the member companies can be formed in no other way.

According to the constitution, the headquarters of the association is located in the city of New York, and the office of the secretary is maintained at the headquarters. This office has been opened at No. 60 Wall St., where the association has three rooms on the sixth floor, containing 750 sq. ft. of floor area. The representatives of the various street railway companies and of the different street railway associations of the country will be most cordially received at the association headquarters.

The Accountants' association has been in existence for a period of eight years and has accomplished much work of importance. The Mechanical & Electrical Association was organized three years ago. At this year's convention in Philadelphia, its name was changed to the American Street & Interurban Railway Engineering Association, and the constitution was so altered as to permit of the admission of maintenance of way engineers to membership. The claim agents' association had its first meeting in St. Louis in 1904, and has already performed valuable service.

The manufacturers' association is somewhat different from the other affiliated associations in that it has no connection with the street railway interests directly. Its chief functions are the production of a most commendable exhibit at the annual convention, and the establishment and maintenance of mutually advantageous relations between the street railway interests and the manufacturers.

The American Street & Interurban Railway Association is pledged to do all in its power to promote the welfare of the affiliated associations which have been organized with its approval to investigate technical matters connected with street and interurban railway construction and operation. Each of these affiliated associations (this does not include the manufacturers' association) is granted financial assistance, and is represented on the executive committee of the parent association. In addition, the latter association co-operates with the various affiliated associations in the editing, printing and binding of their proceedings, and in arranging for conventions and suggesting suitable subjects for investigation. It also files information for reference and distribution, and in every way endeavors to stimulate interest in all of the affiliated associations.

As in the past, a most important part of the work of the association will be that done by the various standing committees. These committees will consider such questions as are of broad and far-reaching influence among the street railway interests of the country. A committee of considerable importance in this connection will be the committee on papers, which will have the general supervision of all papers presented at the convention.

The annual conventions will be conducted along the same general lines as have been prevalent in recent years. The executive committee will select the place at which the convention is to be held, and will not depend upon the invitation of the local railway company to decide this question.

The various affiliated associations as well as the parent association, have annual reports which this year will each contain from 300 to 400 pages octavo. The reports of the affiliated associations are more or less technical, relating as they do, to the specific fields of work for which these associations have been formed.

The idea of an establishment of an information bureau in connection with the work of the association, has long been in the minds of the members who have been prominent in the work of the association. While the companies of greater mileage, for years past, have been accumulating information of such value along specific lines, the bureau will promote a more general interchange of such data between these companies than has been practicable up to the present time. Active investigations of such questions as insurance, taxation, franchise rights, municipal ownership, accident claims, and statutory and municipal laws effecting electric railway companies, are either now under way or will soon be taken up. The accumulation of data will be immediately available to all members of the association. The companies with greater mileage will

thus be relieved of the constant inquiries of the companies with less mileage, and the information thus received, through the secretary's office, will be of greater value.

While the comapnies with less mileage can least afford to make experiments, they also can least afford to make mistakes. Although they may not be vitally interested in municipal ownership, statutory laws, taxation, and accident claims as are the companies with greater mileage, there will be available to them a large fund of information resulting from the long practical experience of such companies.

Active work has already been done on the subject of municipal ownership. The association will keep in touch with the Municipal Ownership Investigating Committee of the National Civic Federation. The work of this committee will be most comprehensive in its scope, and will be of paramount importance to the electric railway interests of the country.

The subject of insurance is now being considered and the association has recently co-operated with the Fire Underwriters on the revision of the National Electric Code.

It is the purpose of the association to issue bulletins at frequent intervals which will contain information concerning different matters of interest to members of the association. These bulletins will be the means of disseminating the data compiled at the association headquarters in connection with the various investigations carried on from time to time.

An important feature worthy of careful consideration is the scale of annual dues payable by active members. It is based upon the annual gross receipts, and represents the best judgment of the reorganized committee. While the new scale of dues is radically different from the old method of assessment, it has had the most careful consideration of the members of the association. It is believed to be fair and equitable to all classes. The association is taking its place among similar national organizations and the new conditions of operation resulting in increased usefulness, require larger expenditures than have been necessary in the past. Calculations based on last year's membership, show that approximately $20,000 income may be expected the first year. This sum is none too large to carry on the important work now under way.

A number of associations have been organized at various times throughout this country and Canada, and many of them are now in a flourishing condition and are doing much work that is of great value. Prominent among these organizations are the state associations of Massachusetts and New York, the New England Street Railway Club, the Canadian association and the interurban associations of Ohio and Indiana. A number of ways may be suggested in which these associations could co-operate with the national organization to the advantage of all concerned.

A scheme of inter-relation which has worked out most profitably among other organizations having mutual interests, is that of an association composed of the secretaries of the individual associations. By this scheme, the secretaries of the various associations meet at stated intervals and discuss various matters of interest to the different associations.

While many of the state associations have not yet arrived at the point where they have found it advisable to publish their annual reports, in many cases this will follow as a natural result of their future development. Several of these associations are now publishing their proceedings, a notable example being the New York State Street Railway Association. A scheme of interchange of the publications at the various associations might prove to be of great value to the members.

In order to make the papers of the various associations of greater value to electric railway people throughout the country, it would be well to have some general committee which would confer as to the papers to be presented and discussed at the meetings of the various associations.

Special investigations relating to different problems could be delegated to certain state associations which would see that investigations were carried out, and that the data obtained would be placed in proper form for publication. By means of bulletins, this information could be sent to the members of the different associations.

In connection with the general conference on papers, it could be arranged that certain special topics would be considered by the various associations at given meetings. To the end that the various associations might become more closely related, it would be advisable for this association to be represented at the annual convention of each of the other associations.

In concluding my remarks on the association and the work to be done now and in the future, I wish to repeat what has been so forcibly brought to your attention by our president; that the American Street & Interurban Railway Association is now entering a sphere of greater usefulness than has heretofore been possible, and that it is vitally essential that its membership be largely increased, to the end that the greatest value and good be received by all companies.

The American Street & Interurban Railway Association does not belong to any one interest, or to any dozen interests. It is not the result of the ideas of one individual or of the ideas of a dozen individuals.

It is not the offspring of the president, although he has given much attention to it in the past, and is devoting much valuable thought and attention to it at the present period of its existence. Neither is it run for the benefit of one interest or set of interests.

The reorganization of the organization, is the result of the labor of many persons throughout a period of more than two years; work undertaken and proceeded with throughout as of paramount importance to the street and interurban railway profession. Many busy men of large affairs have contributed greatly of their valuable time, and of their still more valuable experience and judgment.

The executive committee, the president and all associated with them, stand ready to do everything in their power to make the work of the association of value to its members, but the success of their efforts must depend upon the street railway companies. It is your association, it is yours to make successful, it is yours to reap the benefits.

Personal.

MR. G. H. HUSTIS, formerly auditor of disbursements of the Michigan Central Ry., has been appointed general auditor of the Lackawanna Ry. to succeed O. C. Post, deceased.

MR. R. T. BELL has been made assistant superintendent of the Illinois Traction Co., at Urbana, Ill. Mr. S. Stuckey has been appointed chief engineer at the company's power house in the same city.

MR. ROBERT I. TODD, general manager of the Rhode Island Co., which operates the majority of electric trolley lines in that state, has resigned to become general manager of the Indianapolis Traction & Terminal Co., Indianapolis, Ind.

MR. ARTHUR HOLLAND, who has for a number of years been president of the United Railroads, San Francisco, Cal., has resigned from the company. Mr. Holland has long been an indefatigable worker for the company's interests.

MR. ABEL I. CULVER, vice-president of the Delaware & Hudson Co., has recently been elected vice-president and a director of the Albany United Traction Co., to fill the vacancy caused by the resignation of Francis N. Mann, Jr., of Troy.

MR. EDGAR SPEYER has been appointed to succeed the late Mr. Charles T. Yerkes as chairman of the London Underground Electric Rys. Mr. Speyer is a member of the banking firm by that name, the parent house of which is in Frankfort-on-the-Main, Germany.

MR. H. T. EDGAR has been made manager of the Northern Texas Traction Co., his appointment taking effect Dec. 1, 1905. Mr Edgar's first official act was a thorough investigation of certain departments of the road which will lead to a number of improvements in the service of the company.

MR. JOHN W. LIEB, JR., has been appointed trustee of the American Institute of Electrical Engineers, to represent the institute for a term of three years, upon the board of trustees of the United Engineering Society, invested with the care and administration of the new United Engineering Building.

MR. HENRY C. EBERT, assistant to the third vice-president of the Westinghouse Electric & Manufacturing Co., has resigned his position to become the president of the Cincinnati Car Co. and vice-president of the Ohio Traction Co. Mr. Ebert's connection with the Westinghouse Co. dates back about 15 years. He has successively occupied the positions of superintendent of construction,

chief of the correspondence department, assistant to the manager of the works, and lastly, assistant to the third vice-president. Mr. Ebert enjoys a wide acquaintance among the electrical fraternity.

MR. J. S. HAMLIN, of the St. Louis Car Co., has resigned his position to become identified with the Ohio Brass Co., of Mansfield, O. Previous to his connection with the St. Louis Car Co.. Mr. Hamlin was for the greater part of eight years preceding associated with the National Electric Co. He will be located at Marsfield, O.

MR. C. O. SIMPSON has been elected general manager of the Little Rock Railway & Electric Co., of Little Rock, Ark., to succeed Mr. J. A. Trawick. Mr. Simpson has been in Little Rock for nearly two months past, and he takes charge of the street railway system, thoroughly familiar with all its details.

MR. S. C. SCHENCK has recently resigned his position with the New York office of the Westinghouse Electric & Manufacturing Co., where he was connected with the street railway department, to accept the position of general manager of the Sterling Varnish Co., of Pittsburg, Pa., where he will be located permanently.

MR. R. D. GILLETT has been elected president of the Western Massachusetts and Woronoco Street railways, to succeed Mr. James H. Bryan. Mr. Gillett has been connected with the Woronoco company since 1885, when he was elected secretary and general manager on the consolidation of the Highland and Woronoco companies.

MR. A. W. LEONARD, manager of the Electric Light & Street Railway Co., of Houghton, Mich., has been appointed manager of the Minneapolis General Electric Co., to succeed Mr. A. M. Robertson. Mr. Robertson's resignation is announced and he retires immediately. Mr. Leonard has been with the Houghton companies for three years, and has proved himself to be a capable and popular manager.

MR. J. C. ROTHERY has recently resigned his position as superintendent of the Niagara Falls division of the International Railway Co. and will take charge of one of the properties of the Ohio Finance Co. Previous to Mr. Rothery's departure the employes of the International Railway Co. presented him with a silver service of 78 pieces. Mr. N. P. Baker will succeed Mr. Rothery as division superintendent of the International Railway Co.

MR. JOHN LORENZ, who has for the past three years been the general manager of the Jackson Electric Railway, Light & Power Co., at Jackson, Mo., has tendered his resignation. Mr. Lorenz will become president of the Jackson, Clinton & Western Traction Co., which proposes to build an interurban line from Jackson to Clinton, Mo. Mr. Lorenz has had a wide experience in handling such properties and is a successful manager.

MR. HUGH McGOWAN has resigned from the management of the Indiana Traction & Terminal Co., in order to devote his attention to perfecting the merger of nine Indiana and six Ohio interurban companies, plans for which have been forming for some time. Mr. McGowan will act as president of the Indiana companies and will also retain his position as president of the Indianapolis Traction & Terminal Co., thus keeping in close touch with its affairs.

MR. J. A. BRETT, formerly manager of the railway department in the Chicago office of the Westinghouse Electric & Manufacturing Co., has been transferred to the company's Cincinnati office. Mr. Charles W. Regester, formerly in charge of the Cincinnati business, has succeeded Mr. Brett in the Chicago office. Mr. Brett has been with the Westinghouse company for a year and previous to that time was general manager of the Electrical Installation Co., Chicago.

MR. S. R. DUNBAR, passenger agent of the Indiana Union Traction Co., has announced his resignation. In the resignation of Mr. Dunbar the traction company loses one of its most efficient officials. He has been with the company over three years and during that time has surrounded himself with lasting friends who will regret his departure. It is stated that Mr. Dunbar will associate with E. K. Dunbar & Co., of Boston, Mass., which firm does a general brokerage business in the East.

MR. LOUIS L. SMITH, who was for several years superintendent of the Burlington brass foundry, Aurora, Ill., has recently been placed in charge of the street railway system of Schenectady, N. Y., now owned by the Vanderbilt-Andrews Syndicate. Mr. Smith was with the Great Western R. R. about seven years ago, where he held a responsible position in the company's shops at Olwein, Ia. A few years later he became master mechanic of the New Hampshire Traction Co., at Haverhill, Mass.

MR. G. T. ROGERS, president and Mr. J. P. E. Clark, general manager of the Binghamton Railway Co., were the recipients of handsome Christmas presents from the employes of the company. Mr. Rogers was presented with an ebony gold-headed cane and Mr. Clark with a gold watch. Mr. Rogers and Mr. Clark have been with the company for 16 years, and the presentation of the gifts expresses the very pleasant relations which exist between these gentlemen and the employes of the company.

MR. L. H. REIST, joint passenger agent of the Dayton & Troy and Western Ohio Traction lines, has resigned. Mr. Reist has acted in the capacity of passenger agent for these two lines for about two years. He was the first passenger agent of any traction line in the United States and thus may be accounted a pioneer in that work. He has been remarkably successful and has done much to build up the through business of these lines. It is Mr. Reist's intention to go to New York City, where he expects to return to the theatrical business.

SIR GEORGE GIBB, general manager of the Northeastern R. R., has been elected deputy chairman and managing director of the London Underground Electric Rys. and chairman and managing director of the Metropolitan District Railway Co., which offices were made vacant by the death of Mr. Charles T. Yerkes. Sir George Gibb has been general manager of the Northeastern railroad since 1891 and is well known in the financial circles of Great Britain. He was a member of the committee on the reorganization of the war office in 1901 and of the royal commission on London traffic in 1903.

Obituary.

MISS C. A. BAKER, who has been associated with the Baker Car Heating Co., New York City, since the death of her father, Mr. William C. Baker, died December 6th. Miss Baker was for five years in charge of the management of the company.

MR. FREDERICK UHLMANN died December 13th in his 56th year, at his New York home. Mr. Uhlmann was president of the Brooklyn Elevated Railroad Co. and the receiver of the system during the period of its reorganization and up to the time of its merger with the Brooklyn Rapid Transit System. At the time of his death he was president of the Hinckel Brewing Co., of Albany, N. Y.

Consolidation of the Metropolitan and Interborough Companies.

The Interborough Rapid Transit Co., the Metropolitan Street Railway Co. and the Metropolitan Securities Co., of New York City, are to be consolidated into a new company which it is said will issue securities as follows: Common stock amounting to $90 and 4½ per cent collateral trust bonds amounting to $200 for every share of the Interborough company's stock; 5 per cent cumulative preferred stock amounting to $100 and common stock amounting to $50 for every share of the Metropolitan Street Railway Co's stock; and common stock amounting to $85 for every share of the Metropolitan Securities Co's. stock with $75 per share paid.

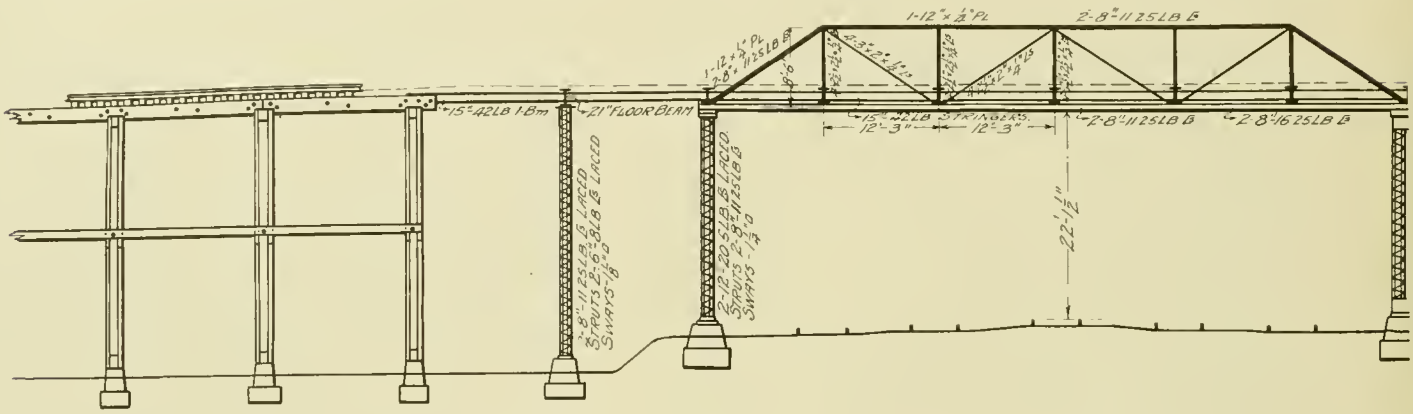
The Metropolitan Securities Co. has a capital of $30,000,000. It owns all the stock of the New York City Railway Co., which leases the Metropolitan Street Railway Co's. property. The Metropolitan Street Railway Co. has a capital of $52,000,000 and it operates 492 miles of street railway, including 393 miles of electric railway. The Interborough company has a capital of $35,000,000. It operates the Rapid Transit Subway in New York and it leases the property of the Manhattan Railway Co. It operates 58 miles of electric railway.

It is believed that the new company will build new subways and elevated lines, and that it will bring about an improvement in the street car service in New York City. It is already predicted that an independent traction company will be formed within a month and that it will bid upon the new routes laid out by the Rapid Transit Commission. The consolidation means smaller operating expenses and this will benefit the stockholders. The New York City Railway Co. reported a deficit of $2,796,942 at the end of its last fiscal year, while the Interborough company has a surplus of some $2,000,000.

New Lima-Findlay Division of the Western Ohio Railway Co.

The Lima, Findlay & Toledo Electric Ry., which is to be operated in connection with and under the direct management of the Western Ohio Railway Co., a description of which appeared in the "Street Railway Review," for March, 1904, was opened Dec. 30, 1905. On account of the physical location of this line and the direct connection it makes with the other railroads of Ohio the beginning of its operation is an event of especial importance.

The new line is 31 miles in length and acts as the direct connecting link between the north and south lines of Michigan, Ohio and Indiana and through its completion makes it possible to travel by electricity to and from nearly all parts of these states.



DESIGN OF CENTER SPANS OF VIADUCT OVER TWO STEAM ROADS NEAR LIMA,

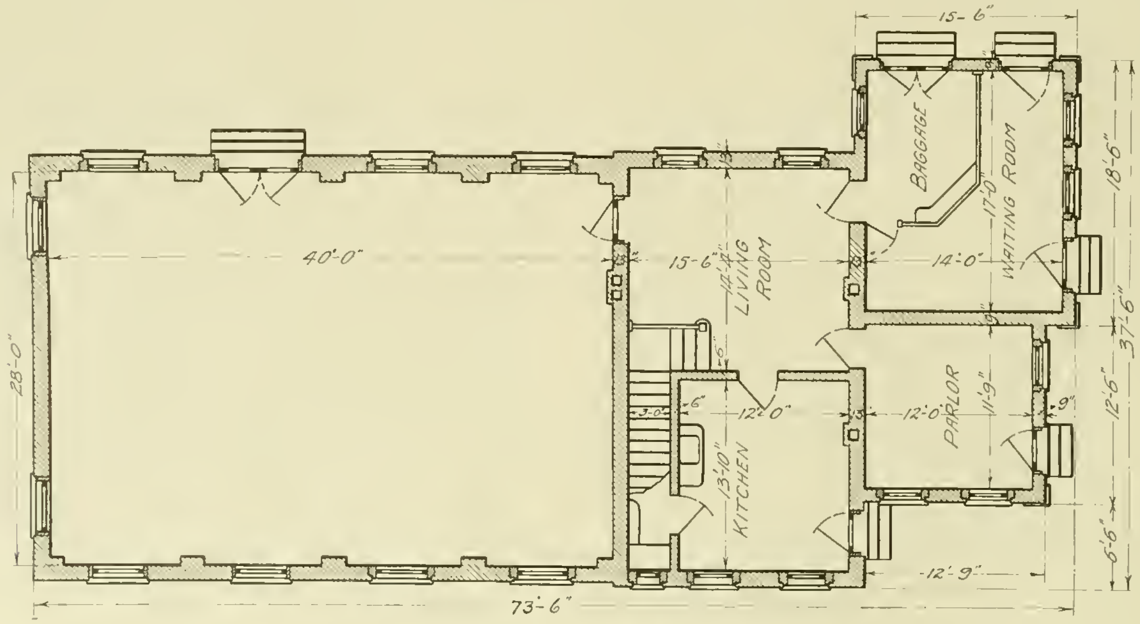
The franchises for the road were obtained in the towns through which it passes three years ago, but the balance of the right of way was not secured until the latter part of the year 1904. Active construction work was begun in January, 1905.

In locating the road bed, care was taken in the elimination of curves and heavy grades. Outside of the corporation limits there are but two sharp curves and the radius of one of these will be lengthened so as to permit a fast schedule. The grades are all below 1½ per cent, with the exception of the viaduct approaches where the grade is 4½ per cent. Both concrete and timber culverts and water passes are now in use but the former will be made standard.

Seventy-pound, A. S. C. E.-section, 30-ft. rails are used. These rest on 6 x 8-in. x 8-ft. hard-wood ties laid with 2-ft. centers. The joints are connected with Ohio Brass Co. 7-in. soldered bonds and four-hole splice bars. The rails are cross-bonded with No. 0000 copper bonds every 1,300 ft. and wires of the same capacity are used in bonding around switches and other special work.

In the towns of Bluffton and Findlay are large stone quarries which makes it possible to use crushed rock for dressing the road at a low cost. Already more than one-half of the roadbed has been given its first dressing. The track is in good condition for a new line and it is believed a rapid schedule can be maintained over it.

Regular traffic was opened over the line January 1, when a two-hour schedule was inaugurated. As soon as the track settles, through trains from Toledo to Cincinnati will be operated regularly. In order to do this the through cars will pass over five different properties. All cars on the new road make connection at Lima with the Fort Wayne, Van Wert & Lima Traction Co. and the Western Ohio Ry. and at Findlay with the Toledo, Bowling Green & Southern Traction Co. and the Toledo, Fostoria & Findlay Ry.



PLAN OF NEW SUBSTATIONS WITH LIVING ROOMS.

On the new line the trolley and feed wires are supported on 35-ft. chestnut poles with minimum 6-in. tops. They are set 7 ft. 6 in. from the track center, 6 ft. in the ground, 100 ft. apart on straight track and 75 ft. on curves. No breast plates are used but where it is necessary "dead men" and guy wires are used to keep the poles in position. The pine arms which carry the three-phase transmission line on 7-in. glass insulators, are 4 x 5 in. x 6 ft. in size and are fastened by a ½ x 13-in. bolt and braced by two ¼ x 1¼ x 24-in. galvanized iron braces. The braces are secured by ⅜ x 2 and 4-in. lag screws. The lower arms supporting the 400,000 cm. feed wire and the two telephone wires, over which the dispatching

is done, are 4 x 5 in. x 4 ft. in size and fastened to the pole in a manner similar to the longer arm. Standard 4-in. pins are used.

The "Christy" brackets and the soldered hangers are used except within the corporation limits, where there are span wires. The trolley is round No. 00 wire suspended 18 ft. above the rails. The trolley supports on the viaduct described later, are made of two inch tubular iron and are set so as to give free passage of cars of all widths.

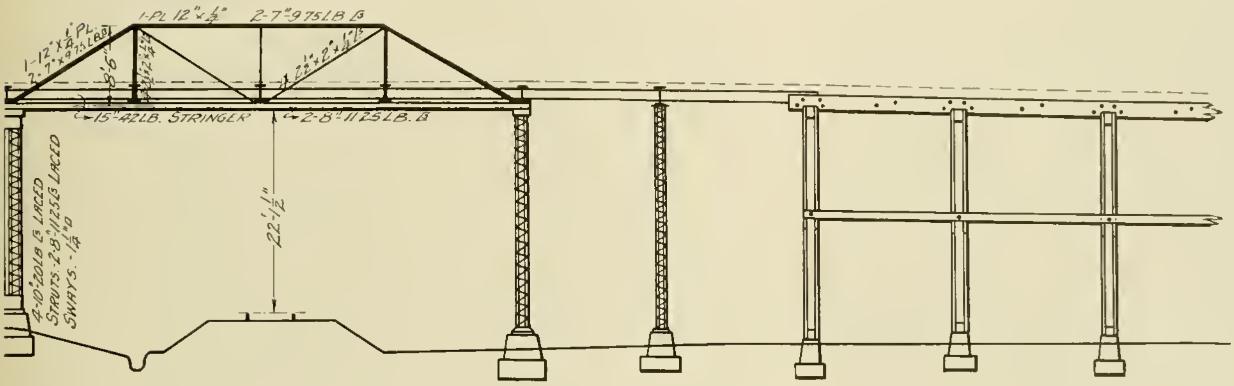
The substations are similar in general design to those on the Western Ohio Ry. The buildings are 74 x 38 ft. in floor area and have a front elevation of 24 ft. On the first floor provision is made for a ticket office, baggage and waiting rooms, and living apartments for the attendant. In the machine room, which is 40 x 30 ft. in size, are two Westinghouse rotaries with the necessary step-down transformers. On the Lima-Findlay & Toledo Ry. there are two sub-stations such as shown in the plan drawing. One is located at Beaver Dam and the other at Rawson. Each is built of brick on concrete foundations and much care was given to the symmetry of their construction so they might prove attractive to look at, as well as serviceable.

Current is brought to the sub-stations on a three-phase high tension line from the Western Ohio Ry. power station located at St. Marys. The rotaries are of 200-kw. capacity each. The line pressure is 33,000 volts.

The high-tension wires of copper run directly from the pole line to a strain bracket securely bolted to the brick walls, thence through 12-in. vitrified brick pipe to the high tension switches just inside of the machine room. The switches are of home manufacture and are operated from the main floor by means of long wooden levers. One direct-current feed wire of 400,000 c.m. cross section is tapped to the trolley at regular intervals.

The viaduct over the Cincinnati, Hamilton & Dayton Ry. and the Columbus, Lima & Milwaukee Ry., located just outside of the city of Lima, is one of the interesting engineering features of the line. It is 1,500 ft. long. The two steel spans over the steam road tracks have a combined length of 130 ft. and the steel structures used in connecting the wooden approaches to the bridges have a length of 32 ft., one either side. The trestle incline on the south side is 672 ft. long and on the north side 528 ft. The viaduct is one of the best built structures in this part of the state. It was constructed at a great expense so that a grade crossing with the lines which it spans might be avoided. There are 76 wooden bents made of 12 x 12-in. timbers set on 12 x 12-in. sills, each of which in turn rests on 4 concrete abutments. Each bent is sway-braced with 3 x 8-in. planks and braced longitudinally by 4 x 8-in. timbers. Long leaf yellow pine double stringers, 7 x 18 in., in section, are used under each rail as a support for the ties. The sills are fastened to the cement pillars by ¾-in. bolts, set in the concrete at the time of its construction. Six bents with steel posts resting on concrete abutments support the steel spans.

The cars on this line are the same as are operated on the other divisions of the Western Ohio Ry. They are 52½ ft. long over-all and have separate baggage, smoking and main compartments with a total seating capacity of 44 people. The company has a number of the old cars which it is enlarging and remodeling into the standard 52½-ft. size. The new cars were made by the Niles Car & Manufacturing Co., Niles, O., and are equipped with 36-in. Schoen solid steel wheels, Peckham trucks, Westinghouse type K 14 controllers, National Electric Co. air brakes and there are four motors of 50-h.p. capacity each.



ON THE NEW LIMA-FINDLAY DIVISION—WESTERN OHIO RAILWAY CO.

A few months ago the Western Ohio Ry. inaugurated a package freight service on all of its lines. This will immedately be extended to the Lima-Findlay route. The plan now followed by the company and the one the management desires to continue is to confine this business to a one trip service. The trains leave the terminals early in the morning and make the round trip over each division. In order to better handle this traffic two trailers constructed on the same plans as the motor cars, are now being built in the company's shops at Wapakoneta. These cars, when put into service with regular trains, will be side-tracked wherever the freight traffic is heavy and loaded and unloaded while the other cars of the train continue on the run over the division. The building of new freight houses in the principal towns is also under consideration by the company.

The Lima-Findlay & Ohio Railway Co. has the same officers as the Western Ohio Railway Co., which is operating the line. They are: A. E. Akins, president; L. J. Wolf, 1st vice-president; F. D. Carpenter, 2nd vice-president and general manager; M. J. Mandelbaum, treasurer; H. C. Lang, secretary. The total trackage now under control of the Western Ohio Railway Co. is 112 miles connecting the termini, Findlay, Piqua and Celina. Through a running track agreement with the Fort Wayne, Van Wert & Lima Traction Co., by which the latter's track is operated over from the Lima city limits to the city office, the Lima-Findlay cars connect directly with the cars running south to Piqua and there with the Dayton & Troy Electric Ry., whose interests are in common with the Western Ohio Railway Co.

The ceremonies incident to the opening of the new line were very appropriate and were witnessed by many men prominently connected with street railway properties in Ohio and adjoining states. In the evening the guests of the officers of the Lima, Findlay & Toledo Electric Ry. were banqueted at one of the Findlay hotels.

The Electric Storage Battery Co., Philadelphia, Pa., has received an order for a battery installation to be used on the Spokane & Inland Ry., Spokane, Wash., the details of which illustrate the flexibility of the storage battery. In this instance the battery is installed to regulate the fluctuations of a single-phase railway load. Power is purchased as three-phase, 60-cycle alternating current, from the Washington Water Power Co. on the maximum demand basis, and delivered, through motor-generator sets, to the single-phase line. Each motor-generator set will be provided with a direct current machine mounted on the same shaft and connected to the terminals of the battery circuit. The battery charge and discharge will be effected by two boosters in the battery circuit operating in parallel with each other, each having a capacity equal to one-half the maximum output of the battery. These boosters will be controlled by the Electric Storage Battery Co.'s carbon regulator adjusted so as to be responsive to fluctuations of the alternating current supply, thus causing the battery to keep the fluctuations within narrow limits.

December and January Meetings and Annual Banquet of Indiana Electric Railway Association.

DECEMBER MEETING, INDIANA ELECTRIC RAILWAY ASSOCIATION.

The December meeting of the Indiana Electric Railway Association was called to order at 11 o'clock a. m., December 14th, by President Henry. The association met in the palm room of the Claypool Hotel at Indianapolis. As announced in notices of the meeting previously sent out by Secretary White, a delegation of about 20 members from the Ohio Interurban Railway Association were welcome visitors at this session.

The minutes of the previous meeting were first read and approved. H. A. Nicholl, general manager of the Indiana Union Traction Co., then read the following report regarding the establishing of a freight bureau:

"The second meeting of the representatives of the freight departments of the various roads was held December 11th, at 1:30 p. m. Present: Messrs. Henry, Reynolds, Nicholl, Hixson, Norveil, Graston, Fletcher, McNown and White. The following resolutions were passed:

"Resolved (1), That a freight bureau be established, but having no power or authority to fix rates; (2) that the general managers or representatives of the several roads meet and formulate plans and rules to regulate the joint freight bureau; (3) that a joint freight agency at Indianapolis be established.

"The following matters to be submitted for consideration and regulation to the general manager's committee:

(1) Joint agency expense; (2) rates, percentage, etc.; (3) interchange of cars; (4) inspection; (5) carload and less-than-carload shipments.

"The chair appointed a committee consisting of Messrs. Reynolds, White and Graston to submit suggestions for suitable trail cars. The general managers' committee, consisting of general managers and other representatives, to consider the above-mentioned matters, will meet in Mr. Henry's office, December 18th, at 1:30 p. m."

Immediately following this report P. J. Mitten, superintendent of motive power of the Indiana Union Traction Co., read a paper entitled "A Desirable Car for Interurban Service." (This paper was published in full on page 872 of the December issue of the "Street Railway Review."—Ed.) In the paper Mr. Mitten outlined his ideas of a desirable interurban car which should be 60 ft. over bumpers, 8 ft. 6 in. wide over sills, 9 ft. 3 in. from floor to underside of ceiling, 10 ft. from underside of sill to top of roof and should stand 3 ft. 6 in. from the top of the rail to the underside of the sill. He suggested details for the interior divisions of the car and for the mechanical construction of the various parts.

C. D. Emmons, when called upon, opened the discussion, saying that in general he agreed with the type of construction as proposed, but noted that the baggage compartment had been left out. He thought that the design of interurban car which nearly all roads sooner or later must accept would have three compartments, set apart as baggage, main and smoking compartments respectively. He would place the toilet room at the rear of the car and the heater in the baggage compartment at the front, with a pipe railing to separate the motorman's space from that used for baggage. He remarked that the standard passenger car of the Indianapolis & Cincinnati Traction Co. met his ideas very closely with the exception that he would desire an unobstructed front view.

H. A. Nicholl suggested the possible design of a car with center entrances constructed after the general lines of the private car "Martha" of the Indiana Union Traction Co., saying that such construction has objections from a mechanical standpoint, but is convenient for operation. The car would be single-ended with a small motorman's space in front, then the main passenger compartment and toilet room. The baggage compartment containing the heater would occupy the rear end of the interior space and the smoking compartment would be placed in the center. Such a design would give the passengers an unobstructed view ahead of the car.

Mr. Emmons thought that an 8-ft. 6-in. car was too narrow and therefore the seats uncomfortable, stating that his road, the Ft. Wayne & Wabash Valley Traction Co., has cars 9 ft. wide which are hardly wide enough. In many cases wider car construction is limited by narrow devil strips and before cars of a suitable width can be operated much track reconstruction will be necessary in cities.

Paul H. White, general manager of the Indianapolis & Martinsville Rapid Transit Co., stated that a desirable car for operation on one road would hardly suit the needs of other roads. He thought that a satisfactory car should be designed with a seating capacity no greater than the average maximum traffic demanded, thus making a saving in the constant load on the power house with regular schedules in operation. Extra crowds could be handled with trailers which are lighter and cost much less than motor cars. The use of trailers would not interfere with the regular schedule of operation if the equipment on the motor cars was designed with this scheme in view. The construction of a 60-ft. interurban car must be very heavy or it will rack and twist when passing over special work and sharp curves, but a 50-ft. car can be made stiff on a proportionately lighter design and seems more desirable since there are but few roads with traffic heavy enough to keep 60-ft. cars well filled.

C. C. Reynolds, general manager of the Indianapolis & Northwestern Traction Co., which road operates the longest cars entering Indianapolis, said that at times it looked ridiculous to carry a few passengers in a 60-ft. car, but at other times cars of this length were too small. He thought the first cost and maintenance charges varied but little between 50 and 60-ft. cars. The 60-ft. cars of this company operate satisfactorily around curves of 36-ft. radius in the city of Indianapolis.

Theodore Stebbins of the Ohio association and general manager for the receivers of the Appleyard properties in Ohio, when questioned, stated that technically speaking the power used by a car should be proportional to its weight, but actual tests have shown that the rule is not accurate. He said that the design of car proposed by Mr. Mitten would hardly suit the needs in western Ohio because the roads there, on account of physical conditions, use double-ended cars. He favored the use of a light type of car and more of them, citing the case of a road entering Columbus, O. This road operates 60-ft. cars, sometimes two in a train, in and out through the streets of Columbus with no objections from the municipality.

Mr. Stebbins then outlined the present situation in regard to the standardizing of the widths of equipment so that the cars of one road may operate over any connecting line. He thought that the roads of the two neighboring states should maintain the same standards and eventually widen the devil strips until through-line operation for large equipments is possible. In dividing the interior space of cars, provision must be made for handling baggage, but the large side doors of a baggage compartment are unsightly and perhaps a car can be designed with a special baggage compartment under the floor and between the trucks.

W. G. Irwin favored the providing of a compartment for light express matter, saying that sooner or later the electric roads must compete with the express companies operating on the steam roads by carrying light express matter on passenger trains.

F. D. Carpenter said that when the cars for his road, the Western Ohio Railway Co., were originally purchased they had but two compartments. It has since been necessary to splice on an 8-ft. baggage compartment, thus making the rebuilt cars 52 ft. 6 in. long. These cars are double ended and suit the physical conditions of the property. It has been found that the rebuilt cars ride more smoothly now that the length has been increased.

C. A. Baldwin, superintendent of transportation, Indiana Union Traction Co., thought that the passenger, freight and express service should be kept separate. He suggested that combination cars be run every other hour between the cars intended for passenger service only except at those times of day when the cars are always crowded, as at 4, 5 and 6 o'clock in the afternoon.

S. H. Knight noted that the lengthening of the car by 10 ft. did not increase the total weight in direct proportion to the amount of passenger space gained. Neither does the lengthening of a car increase the air resistance, the power house load or the maintenance charge to any appreciable amount.

President Henry said that the earliest types of interurban cars had end doors so that passengers could easily pass from one car to another. These cars also had smoking compartments, and their general design is still maintained by many roads. While he did not favor the smoking compartments, the traffic demanded them and so they must be supplied. Baggage compartments are required by the traffic of nearly all roads and the express matter can be handled in the baggage compartments. In a single-ended car he would put the heater at the front near the motorman, thus assuring the warming of the coldest part of the car.

Mr. Henry asked for information regarding the use of advertisements in cars, saying that he would like to have the money which the space earned, but did not care to disfigure the cars with the signs. With a single-end car he did not favor a front vestibule. The length of the car between certain limits seemed unimportant. On a branch of his road between Shelbyville and Indianapolis $669 worth of traffic was handled by three small cars, last Fourth of July. The running of small cars in this instance was made necessary by the limited power supply, but it showed what can be done with small cars. Too much attention cannot be paid to the trucks. When Mr. Henry bought the first heavy trucks for the Indiana Union Traction Co. he looked about for a satisfactory design, but not being able to find one, had a special design made which is heavy enough to be perfectly safe and uses steel-tired wheels. In the latest design of cars for the Indianapolis & Cincinnati Traction Co. he had the partitions placed so that the smoking compartment is as small as possible, with the partition itself made of glass. Experience had shown him that there is much less rowdyism in a smoking compartment when the smokers are in plain sight of the other passengers. These cars have a solid partition between the smoking and baggage compartments, because the handling of baggage would quickly destroy any glass placed in the partition. He did not believe that passengers should be given a clear view through the front end of the car, because even though it might add to the pleasure of the ride, many passengers would have a tendency to offer objections to the methods of operation. He would place the toilet room at the rear of the car. The operation of trailers tends to increase the schedule, and therefore he would operate motor cars in trains when traffic demanded, saying that there are, however, times when it is not necessary to maintain schedules and rush traffic can be handled with trailers. His suggestions for a satisfactory car were that it should be as light as consistent with the work required, have the best type of truck, plenty of motor capacity, a baggage room containing the car heater at the front with the smoking and ladies' compartments in their order at the rear.

Mr. Mitten brought out a new argument for a clear view ahead of the passengers, saying that he had seen instances in which people who became car sick from riding at the rear end recovered quickly if taken to the front end and allowed to look ahead. He thought that the heater when placed close to the front windows might create a frost on the glass in front of the motorman.

Mr. White said that he had found that trailers could be operated satisfactorily by his motor cars, which are 47 ft. long and equipped with four 50-h. p. motors.

G. H. Kelsay, superintendent of power, Indiana Union Traction Co., said that express matter should be handled each hour and trunks should be taken care of. He thought it quite possible to design a car with a compartment under the floor in which trunks and express matter could be carried, as Mr. Stebbins had suggested. He would not add to the motorman's duties by asking him to take care of the heater, but would put the heater in the baggage compartment, where the ashes would be least objectionable. He favored an unobstructed front view, since it adds to the pleasure of many passengers. Trucks for interurban cars should be very strong mechanically, as they are most important for safety.

He would build the car with the front vestibule on a continuous frame with the body and with the rear vestibule lowered. He thought that the interurban cars should be single ended and that the additional cost for double-end cars would offset the construction cost of Y's.

M. H. Evans, master mechanic of the Indianapolis Traction & Terminal Co., favored single-end cars heated by hot water. The frames should be designed stronger, which might perhaps necessitate doing away with trap doors and making the floor construction continuous from buffer to buffer. A car thus designed could hardly be telescoped. He saw no reason why the vestibules could not be closed on one side, thus making the car body stiffer. Standards of equipment should be developed, using those of the Master Car Builders' Association when applicable, stating, for example, that there are no standards for couplers, wheel treads, brake shoes and brake heads; in fact, all fittings should be simplified. Interurban cars should be equipped with four motors, since it had been demonstrated that such equipments are maintained at the least cost.

On the conclusion of the discussion of Mr. Mitten's paper by Mr. Evans, President Henry called upon Edward C. Spring, president of the Ohio Interuban Railway Association, to address the members present.

Mr. Spring spoke of the desire of the Ohio association for unity of work in the two state associations. At the request of the executive committee of the Ohio association he had come to talk with President Henry, who desired that he express his errand directly to the assembly. Mr. Spring stated the needs for a permanent secretary who could care for the mileage books, advertising and publicity of the different roads. It was important that the interurban roads be given more publicity, and this could be done by a permanent officer. A suggestion had been made that each road pay the combined association $50 per year in installments of $5 per month to be used for the maintenance of a permanent office. He would suggest following in a way the plan of the New England Street Railway Club, and asked that the Indiana association take action on the question of uniting with the Ohio association.

The remarks of Mr. Spring were seconded by F. D. Carpenter, general manager of the Western Ohio Railway Co.

C. C. Reynolds moved that a committee of five be appointed to discuss with a similar committee from the Ohio association the question of uniting the organizations. The motion was carried, and at the suggestion of the members the following committee appointed: Charles L. Henry, C. C. Reynolds, C. D. Emmons, Arthur W. Brady, W. G. Irwin.

As but two questions had been submitted to Mr. Kelsay, chairman of the Question Box Committee, these were not taken up, but were given to the members to discuss at the next meeting.

The association then adjourned until January 11th.

FIRST ANNUAL MEETING OF THE INDIANA ELECTRIC RAILWAY ASSOCIATION.

The first annual meeting of the Indiana Electric Railway Association was held at the Claypool Hotel, Indianapolis, on Jan. 11, 1906. The meeting was called to order by President Henry at 2:15 p. m. In the absence of Paul H. White, F. D. Norveil, Indianapolis & Northwestern Traction Co., acted as secretary. Mr. Norveil read the minutes of the previous meeting, which were approved as read. President Henry suggested that the election of officers be deferred until the close of the meeting, and it was then moved that a nominating committee be appointed. The committee appointed consisted of C. D. Emmons, Fort Wayne & Wabash Valley Traction Co.; H. A. Nicholl, Indiana Union Traction Co., and A. A. Anderson, Indianapolis & Cincinnati Traction Co.

President Henry then made a report of the action of the committee appointed to confer with the Ohio committee on the subject of uniting the two associations. The committee from Ohio is composed of Edward C. Spring, Theodore Stebbins, F. D. Carpenter, Harrie P. Clegg and J. O. Wilson. The Indiana association appointed President Henry, Joseph Irwin, A. W. Brady, C. C. Reynolds and C. D. Emmons to confer with the Ohio committee.

President Henry reported that the sense of the joint committee meeting was favorable to consolidation and recommended that a

committee of five be appointed on behalf of the Indiana Association with power to act.

H. A. Nicholl moved to adopt the report of the committee and that a committee of five be appointed with power to act. The motion was carried.

A. W. Brady said that the joint committee had canvassed the subject of consolidation with much care. The committee was unbiased and had decided the question upon its merits. Great advantages were to be derived from consolidation. The practical usefulness of both associations would be much increased and there would be an avoidance of waste in thrashing out the same questions in both associations. He suggested that the appointment of a permanent secretary would be of great advantage to all concerned. The secretary would be subject to the call for information of any member of the joint association. The objection to be found in consolidation was that the membership would be made so extensive that the place of meeting would be difficult to reach. This did not seem to be great enough to counterbalance the advantages to be derived. He suggested that the meetings be held less frequently, as more effort would then be made to attend, and that the joint association should be known as the Central Electric Railway Association.

President Spring, of the Ohio association, suggested that the method of government of the new association be by the appointment of a president and two vice-presidents, one from Indiana and one from Ohio. The presidency to alternate between Ohio and Indiana. He also suggested that the executive committee be composed of five members from Ohio and five from Indiana. He did not think it advisable to confine the association to Ohio and Indiana and thought that membership could be extended to other adjoining states. He said that the Ohio association had authorized its committee to act.

It was regularly moved that a committee be appointed to confer with the Ohio committee and that they be given power to act. The motion was carried and the original committee was reappointed.

President Henry then introduced Charles T. Mordock, superintendent of power, Terre Haute Traction & Light Co., who read a paper on "Turbines." In his paper the author described the functions of a satisfactory turbine and gave a large amount of data regarding turbine construction and operation.

In the discussion which followed, Geo. H. Kelsay, superintendent of power, Indiana Union Traction Co., said that actual practice seemed to show that the turbine has little advantage over the reciprocating engine. Some of the good features in the turbine are its high speed, small floor space, uniform angular velocity, simpicity of operation and small amount of attendance required. He said that the best result from turbine tests that he knew of showed a steam consumption of 11.17 lb. per brake h. p., obtained with 28 in. of vacuum and 182 degrees of superheat. The best record for a piston engine was 9 lb. of steam per brake h. p. The efficiency of turbines depends largely on the degree of superheat and the vacuum. A high vacuum gives a freer passage of steam through the turbine blades with less friction.

Figures were presented illustrating the effect of various degrees of superheat. It was stated that a difference of 23 per cent in efficiency was obtained when operating with 25 in. of vacuum and no superheat as against 28 in. of vacuum and 125 degrees of superheat.

In answer to the question of whether a turbine was as efficient after running four or five years as when first installed, Mr. Nicholl said that he knew of two on the Cleveland & Southwestern Traction Co's. road which had been running two years and were about as efficient at the end of that time as when installed He thought that turbines were more economical than reciprocating engines under any load put upon them.

Mr. Mordock said that he could see no reason why a turbine should not be as efficient after running a reasonable period of time as at the beginning, and that results obtained under his observation bore him out in this statement.

When questioned as to the cost of turbines Mr. Mordock said that a 500-kw. turbine cost about $1,900, and that a 1,500-kw. turbine cost about $4,100 complete.

Mr. Henry said that the engineer had wandered away, but was gradually coming back to first principles. He thought turbines were especially adapted to the generating of electricity, one reason being that greater armature speed is obtained than with reciprocating engines.

President Henry then announced that the Question Box would next come before the meeting.

Mr. Kelsay read the following question: Is a conductor on an electric car liable for embezzlement under the Indiana statutes in case he finds a ticket upon the street or in his car and gives it away to be used by a passenger?

Mr. Brady, who had been asked to lead the discussion, said that it was his opinion that the conductor in this case would be liable for embezzlement. He then read the following question: What amount is legal tender for the payment of fare, and has the conductor the right on receipt of a $20 bill in payment of a 20-cent fare to give the passenger an order on the company for $19.80? He thought that the conductor was well within his rights in doing this, and that if the purpose of the passenger was to annoy the conductor, that the conductor had adopted a course to be commended. He said that the question of the proper amount to be tendered in payment of fare was a difficult one which could only be solved by common sense principles. He thought it the duty of passengers to tender as nearly as possible the exact amount due, and that the question in relation to the interurban road differed from its application to street railways in the fact that interurban companies charged higher rates of fare.

Mr. Kelsay then read the following question: Have the interurban and street railway companies become sufficiently numerous and wealthy as to make it possible to reduce the important items of insurance premiums by the formation of a mutual insurance company similar to the well-known factory mutual insurance associations which takes care of a certain line of risks? This question was referred to Mr. Nicholl.

Mr. Norveil then made an announcement regarding the banquet which was to be held at 6 o'clock.

President Henry announced that Paul H. White had severed his connection with the traction work and gone into other fields of labor, and that Mr. Norveil had taken up the work on very short notice.

The committee on nominations then reported the following list of nominees: C. L. Henry, president; A. W. Brady, vice-president; F. D. Norveil, secretary; W. F. Milholland, treasurer. Executive committee, H. A. Nicholl, C. C. Reynolds and G. F. Wells. Finance committee, Chas. Murdock and W. G. Irwin.

The report of the committee was adopted and the secretary was instructed to cast a unanimous ballot.

F. M. Fauvre, Indianapolis & Eastern Railway Co., moved that a vote of thanks be accorded to the officers and members of the committees for their work during the past year. The report of the treasurer was read. The finances of the association showed a good balance. The meeting adjourned at 4 p. m.

At the close of the meeting the joint committee on consolidation went into session and it was then decided that the consolidation be effected. The final plans for this action will be arranged at the coming meeting of the Ohio association at Dayton, Ohio, on January 25th. At this meeting the following list of officers for the joint association will be recommended; President E. C. Spring, Ohio; vice-presidents, F. D. Carpenter, Ohio, and C. L. Henry, Indiana; treasurer, W. F. Milholland, Indiana. It will be further recommended that an executive committee of 13 members be appointed, consisting of the president, and the two vice-presidents, ex-officio, the other members to be appointed by the joint association. The permanent secretary will be selected by the joint organization.

Annual Banquet.

At 6 p. m. a very elaborate banquet was served in the ladies' dining room on the second floor of the Claypool Hotel. A. W. Brady acted as toastmaster. In his opening remarks, Mr. Brady referred to the banquet as the wake of the Indiana association. He spoke of the growth of the association and said that it had much to be proud of. He then introduced as the speaker of the evening the Hon. Chas. L. Henry, whom he referred to as a pioneer in Indiana electric railway enterprise. Mr. Henry's address follows:

President Henry's address.

Mr. Toastmaster and Gentlemen:

Tonight closes the first year of the organization of the Indiana Electric Railway Association. During the year we have lost from our midst our first vice-president, J. W. Chipman, of the Indianapolis & Eastern line, the man who more than any other was in-

strumental in bringing about the organization of this association. Mr. Chipman was an energetic, capable and earnest officer of his company, and very early appreciated the advantages to be gained by an association such as ours for the discussion and consideration of questions of mutual interest. He was genial in manner, a pleasant companion and a safe counseler in all matters pertaining to our business. His untimely demise deprived his interurban company of an efficient officer and this association of one of its most desirable members.

During the year, also, we have lost, by removal from the state, one of our executive committee, Mr. A. L. Drum, who has gone into other fields of labor; but to take his place we are fortunate in having with us tonight Mr. H. A. Nicholl, who succeeds Mr. Drum with the Indiana Union Traction Co.

And tonight, as the year closes, I deem it wise that we should look back, take our bearings, and see what has been accomplished.

Our organization, itself young in months, represents an industry still young in years. The first successful operation of an electric railway in this country was in the city of Richmond, Va., in January of the year 1889. Not long after this the railway in the city of Lafayette, Ind., the first in the state, was equipped electrically. Soon afterward the Fairview Park line in Indianapolis was operated with electric cars, and other electric railway plants followed in quick succession.

While the improvements in and developments of electric lines that are purely street railway properties are very interesting and instructive, I shall confine my remarks chiefly to the development of the interurban electric railway service.

I first became interested in electric railways in the fall of 1891 in the city of Anderson, and soon thereafter began to contemplate the possibilities of interurban electric railways.

Being quite well acquainted with the situation in southwest Missouri, my first idea was to connect the cities of Joplin, Webb City and Carthage with an electric railway, and in November, 1902, I visited those cities with a view to working up the project. I succeeded in getting a contract for the Carthage Street Ry., then a horse line, but failed to obtain a contract for the Webb City or Joplin properties. After several months of vain endeavor to accomplish this, and having the subject strongly impressed upon my mind, I took up the idea of interurban service between what were known as the Gas Belt Cities in Indiana.

The panic of 1893 brought everything to a standstill, and for many months nothing was done.

In the winter of 1893-4 I made the first estimate of cost and prospective earnings, together with a blue print map covering the lines from Anderson to Marion, Anderson to Elwood, and Muncie via Anderson to Indianapolis, exactly as they were afterwards built except that the line to Elwood was first planned to run through Frankton instead of west from Alexandria as it was finally built.

Soon after, I commenced securing options on land for a private right of way for a line from Anderson to Alexandria, and from Anderson to Elwood. The possibilities of the enterprise constantly grew on me, but I could not convince any one able to furnish the necessary capital that it would be a profitable venture, so that no substantial progress had been made when the financial depression incident to the great political campaign of 1896 spread over the country, paralyzing all business enterprises.

In the meantime the desirability of interurban electric railway service had attracted the attention of many other people. Among these was one Noah J. Clodfelter, who took up the project of building a line from Indianapolis via Anderson to Marion, and was much heard of in the public prints during the next few years, and finally in the year 1898 he did some work toward building a line from Marion south to Fairmount, and laid rail in the city of Fairmount, which afterwards passed by receiver's sale to the Marion Street Railway Co. and was used as a part of the line built by that company from Marion via Fairmount to Summitville.

In September, 1897, I organized the original "Union Traction Co." and commenced the construction of an interurban line from Anderson to Alexandria, and on the first day of January, 1898, the first interurban car in Indiana ran from the city of Anderson to the city of Alexandria, a distance of 11 miles. Early the next year this road was extended to Summitville, making a total distance of 17 miles, at which point connection was afterwards made by the line built from Marion south by the Marion Street Railway Co., a like distance of 17 miles, giving a continuous line of 34 miles from Anderson to Marion, but owned by two different companies.

At this point I desire to call attention to the fact, which should be known and not forgotten, that it was an Indiana man, Philip Matter, of Marion, who loaned me the money necessary to commence the first interurban line, and that another Indiana man, John P. Frenzel, president of the Indiana Trust Co., bought the first bonds to the amount of $450,000 issued upon the property of the Union Traction Co., which then included by consolidation the electric lines in the city of Anderson.

Much has been said about outside capital, and much credit is due to outside capital in the development of our state, but I take pleasure in calling attention to the fact that Indiana men first loaned Indiana money to commence the development of Indiana interurban railroads.

The successful operation of the cars on this first section of the interurban system induced me to take up with my friend, George F. McCullough, of Muncie, who then owned the electric railway in that city, the proposition of joining our interests and building a line from Muncie via Anderson to Indianapolis.

Fortunate indeed for the future of electric railways in Indiana there came to Indiana on New Year's Day, 1899, that broad-minded gentleman, Mr. Hugh J. McGowan. Coming as the representative of the Dolan-Morgan Syndicate, which had recently purchased the Indianapolis Street Rys., he at once commenced the development of that system and soon made it the best city railway system in the United States. Mr. E. M. Campbell, of this city, introduced me to Mr. McGowan soon after he came among us, and to him I presented the interurban project under consideration, and later, through his introduction, Mr. McCullough and I took up the matter with Mr. Randall Morgan, of Philadelphia.

After a full presentation of the matter, Mr. Morgan had a thorough inspection of the property made by Mr. David Young, of Jersey City, and agreed to join with us in the organization of the Union Traction Co., of Indiana, a consolidated company which would embrace the electric lines in the cities of Muncie, Marion, Anderson and Elwood, and interurban lines connecting, and including the proposed line from Muncie via Anderson to Indianapolis. The final organization of this consolidated company was completed late in the month of June, 1899, and work was at once commenced on the construction of the Muncie-Indianapolis line, and on the 4th day of January, 1901, the line was completed and its first car ran into the city of Indianapolis.

In the meantime the line from Alexandria to Elwood had been completed, and the system as planned in 1893 was at last a reality, just 3 years and 3 days from the time the first car ran from Anderson to Alexandria.

Soon after this, in March, 1901, I sold my interest in the Union Traction Co., of Indiana and ceased to be its general manager. The subsequent development of the system is a story for others to tell.

Looking forward to the completion of the line into Indianapolis, as early as 1894 I took up the subject of a contract with the local company for running cars into this city, and in February, 1895, I secured a contract with the Citizens' Street Railway Co., then controlled by what was known as the McKee & Verner Syndicate, of Pittsburg. The contract was executed by Augustus L. Mason as president of the city company, and by me for the benefit of the interurban company thereafter to be organized. It provided that the city company should take charge of the cars at the city limits, collect and retain the city fares, and re-deliver the cars to our company again at the city limits. It also provided for the handling of mail, express matter and freight upon terms as to price to be thereafter agreed upon, and upon failure to agree, then to be fixed by arbitration.

At this point I desire to call attention to the fact that the first corporation formed for the building of an interurban electric railway was the Indianapolis, Greenwood & Franklin Railroad Co., organized Nov. 9, 1894, under the steam railroad law, and being promoted by Henry L. Smith, of this city. The road from Indianapolis to Greenwood was afterwards built by this same organization under the ownership of Joseph I. and Wm. G. Irwin, of Columbus, Ind., who took charge of the company in June, 1899, and it was this road that ran the first interurban car into Indianapolis on the 1st day of January, 1900. This company was succeeded by the Indianapolis, Columbus & Southern Traction Co., owned and controlled by the Messrs. Irwin.

The building and equipment of the first interurban lines presented many interesting questions. Perhaps the most serious in the beginning was the distribution of power, for at that time the idea of one central power station transmitting current at high voltage to various sub-stations, where the voltage should be reduced, had not been tried. In the power station at Anderson, in order to enable us to have sufficient voltage on the Alexandria-Summitville section of our road, we installed what was known as a "booster," which was a generator developing electric current at 750 volts This we transmitted by a separate line to the Alexandria-Summitville section, and the drop of the voltage by transmission was sufficient to give us approximately 500 volts on that part of the line.

When the Union Traction Co., of Indiana, was formed the great central power station at Anderson was erected with sub-stations, a system which has since been generally followed.

The wonderful growth of the electric railway business is illustrated by the fact that the first generator equipment in the Anderson station in the fall of 1891 was a 75-h. p. bi-polar Edison machine belted to a 125-h. p. corliss engine, operating 2 cars on a 2-mile run to North Anderson; and that station has grown from this small beginning until today it contains five 1,000-kw. direct-connected generators, with a combined overload capacity of 7,500 kw., and operating an entire system of 220 miles of interurban railroad, together with about 50 miles of road in the cities touched hy it.

Our first interurban line was to begin with operated by a block signal system, but this caused too many long delays, and not proving satisfactory the line was soon equipped with telephone service, much the same as is now in use.

We realized that if high speed with heavy cars was to be attained it would be necessary to have a more satisfactory brake equipment than that operated by hand. For this reason in the original estimate covering the equipment proposition, although such a thing was not then made, an electric motor driven air compressor was provided for, and its estimated price fixed at $750 per car. Since then this system of brakes has been brought to perfection and is now common on interurban cars.

Steel tired wheels were also included in this estimate.

I invented the word "Interurban" for this class of railroads, and though it is not perhaps well selected, it has come into general use, although not yet found in any of our dictionaries. One of the Anderson newspapers becoming piqued at some act on the part of the management relating to free transportation, dignified the new name by calling it "Inter-Ruben," and this name in jest clung to the road quite a while.

Since those early days the interurban business in Indiana has developed rapidly until a recent estimate made bv persons in close touch with many of the roads, gives us near 1,500 miles of interurban roads in the state at this time, representing an actual investment of approximately $45,000,000. Nine of these roads center in the city of Indianapolis, and all receive and discharge their passengers in a beautiful terminal station erected bv the Indianapolis Traction & Terminal Co., a station unequaled in beauty and convenience in the United States.

Rapid progress has been made in other parts of the state, notably in and about the two cities of Ft. Wayne and South Bend in the north, and Lafayette and Terre Haute in the west.

During the first year of the existence of our association many subjects of vital interest have been discussed, this exchange of views resulting in great benefit to all departments of the business. As an outgrowth of our organization we now have a central passenger agency in the terminal station in this city, and at this time the subject of a central freight and express agency is being seriously considered. Our organization also has to its credit the adoption, along with our sister states of Ohio and Michigan, of the interchangeable coupon ticket, good on 33 roads in those three states.

Nearly all of the roads have embarked in the freight and express business, but we all concede that this branch of the business is in its infancy.

What the future will bring we can but conjecture. Certain it is that if 70 per cent of all the receipts of the steam roads come from freight, the interurban traction roads may reasonably expect that their income will be greatly augmented if not doubled by a careful development of the freight and express business.

Looking hack and looking forward, judging the future by the past, we have a right to expect that while wonderful progress has been made in the last eight years, even greater progress will be made in the coming eight years. Open links between the various lines will be filled; better tracks and road beds constructed; cars more substantial and more comfortable will be built; higher speed and greater safety attained; and whereas much has been done, much more will be done in the development of the great interurban traction business in Indiana.

This association has accomplished much good in the first 12 months of its existence, and tonight as we gather round this festal board let us look into the future with renewed zeal and increased knowledge and go forward to the completion of the great task that is set before us.

At the conclusion of Mr. Henry's address Mr. Brady spoke of the importance of uniting the traction interests of Indiana and Ohio, which, he said, would aid materially in bringing together the people of the two states. He said that they were pleased to have with them the members of the Ohio association, and called on Mr. C. A. Baldwin to welcome them.

Mr. Baldwin spoke as follows:

Mr. Toastmaster, our visitors and members of the Indiana Association:

In behalf of the Indiana Electrical Railway Association I have been asked to welcome you to our meetings.

For this association, I am glad to say that the first step by you to become better acquainted with your Indiana neighbors will redound to our mutual benefit in many ways.

I have visited several roads and I have learned that no matter how small the road there is always something noticeable that would be profitable for a large road to endorse.

I hope you will all find some things of interest in this trip, and by the time you are to again resume your daily routine of duties that you will feel that you have profited by attending this, our first anniversary meeting.

Frequent visits and meetings of this kind will have a tendency to broaden our views and teach us to work more in unison, so that the traveling public from the Buckeye State to Hoosierdom, or vice-versa, will not know but that it is all one system.

I once heard a story of Cornelius Vanderbilt, who was out looking over his different properties, and asked his young civil engineer what was the best and cheapest way to maintain a track and roadbed. The young man studied for a moment and answered that good drainage would be the cheapest. Mr. Vanderbilt then asked the young engineer what would be the next cheapest. The young man studied for a moment and said, "More drainage."

So I think if one visit will prove profitable to you, more visits will prove more profitable.

I hope that arrangements can be made in some way whereby such meetings as this can be held frequently, and that our mutual relations toward each other, socially as well as in a business way, will be noticeably strengthened by them.

Allow me again to welcome you to our meetings.

Mr. Brady then called on President Spring, of the Ohio association, to tell of the feeling of the Ohio association toward that of Indiana and what he thought the future of the joint association would contain.

Mr. Spring said that when he left home that morning to come to the meeting his little boy had said to him, "Papa, where are you going?" and on being told that Indiana was his father's objective point, asked, "Papa, where is Indiana?" His father told him that Indiana was the home of his old Aunt Mary, and then he knew where Indiana was. Mr. Spring said that the banquet was a great surprise to himself and to Mr. Carpenter and that the kind words of greeting from Indiana touched him very deeply. He said that the delegates had come from Ohio with fear and trembling, but that the fear had been dispelled by the expressions of good fellowship extended. He congratulated the Indiana association upon its decision to combine with Ohio and in turn congratulated Ohio upon having, in the future, such an efficient collaborator. He said that the eyes of the electrical world were turned upon Indiana and Ohio and that the development of the two states would be watched. He hoped that when the committee from Indiana came to Ohio on January 25th that a new era would be started with the watchword, "Indiana and Ohio, One and Inseparable."

Mr. Brady then said the large portion of the people for which the traction companies work believe that their only idea is to plan

how many more people they can crowd on one car and just how unsatisfactory they could make the service. He said that they had other work to perform in meeting the supply man. At times they were welcome and at other times they were not so welcome. When they had something with which the traction people wanted they were very agreeable men indeed. He called on Mr. Drake to speak in behalf of the supply man.

Mr. Drake expressed his pleasure in speaking and said that the supply man was by way of being a specialist. His duty was not to educate the public but to supply them with what they require.

Mr. Brady then said that there were two classes of unfortunates who served the great public. That no matter how hard they tried, the public reviled them both. He referred to the street railway people and to the newspaper men. He said that the press of Indiana was of the utmost importance in the development of street railway interests and introduced as the next speaker Mr. Ernest Bross, editor of the "Indianapolis Star."

Mr. Bross expressed his appreciation of the honor accorded him and wondered whether it was worse to be placed at the beginning of the program when one did not know what to say than at the end when everybody had said what was in one's mind. He spoke of the advantages of combination and protested against the tyranny of the old established order of conservatism.

Mr. Brady then called upon Mr. Thistlewaite of the "Indianapolis News," who expressed the best wishes of the "News" for the long life and prosperity of the joint association.

The banquet closed with a toast to the peaceful rest of the Indiana Electric Railway Association and to the future success of the Central Electric Railway Association.

Several Michigan Properties United.

A syndicate headed by Myron W. Mills, president of the Lansing & Suburban Traction Co., George G. Moore, vice-president, and James R. Elliott, general manager of the same company, has recently purchased from the Railways Company General the property known as the Michigan Traction Co. The purchase included a total of 54 miles of track in the two cities and connecting them. This syndicate now controls the Lansing & Suburban Traction Co., 36 miles; the Jackson & Battle Creek high-speed, third-rail line, 46 miles, and the new purchase. It is understood that with these properties will be affiliated the Jackson & Ann Arbor line, which it is expected will be completed to Detroit at an early date. By this combination of routes it will be possible to operate through cars from Kalamazoo to Detroit, a direct route extending nearly across the state of Michigan. The Mills-Moore-Elliott syndicate now has under construction a connecting link between Lansing and Jackson, which will physically connect all the trackage now controlled. James R. Elliott will manage all the properties, E. S. Loomis will be superintendent of the line from Jackson to Kalamazoo, J. J. Martindale, superintendent of the Battle Creek city line, and T. L. Keely, superintendent of the Kalamazoo city line.

At a recent meeting of the Woronoco Street Railway Co., the following officers were elected: President, R. D. Gillett; vice-president, R. B. Crane; secretary and treasurer, C. J. Little; general manager, A. D. Robinson; attorney, H. W. Ely; directors, R. D. Gillett, R. B. Crane, C. J. Little, A. D. Robinson, H. W. Ely, J. A. Crane, A. W. Eaton, J. H. Bryan and H. C. Page.

The National Civic Federation, 281 Fourth Ave., New York City, has undertaken the investigation of municipal ownership in America and Europe and a committee of 21 has been appointed to study the subject. This committee includes Dr. Albert Shaw, editor of the "Review of Reviews," New York City; Mr. Talcott Williams, of the editorial staff of the Philadelphia "Press;" Prof. Frank J. Goodnow, of Columbia University, New York City; Prof. Edward W. Bemis, superintendent of water-works, Cleveland, O., and Dr. Milo R. Maltbie, of New York City, formerly editor of "Municipal Affairs." The last three are on a sub-committee to formulate a plan for the investigation.

New Cars for the Cleveland & Southwestern Traction Co.

The Cleveland & Southwestern Traction Co. has recently received from the St. Louis Car Co. 10 new, 51-ft. combination passenger and smoking cars. The car has a width of 8 ft. 7 in. over all. The height from the rail to the top of the roof is 12 ft. 1½ in.

The main passenger compartment has an inside length of 22 ft. 10 in. It contains 15 stationary seats, covered with green plush and having high backs with head roll. The seats are furnished with mahogany arms and stationary foot rests. The smoking compartment has a length of 11 ft. 2½ in. inside, and has six seats of the same type as those in the main passenger compartment, together with a sofa placed against the partition. The baggage compartment has an inside length of 10 ft. 5¾ in. and is arranged with one sliding door on each side 3 ft. 4 in. wide. Three drop sash are placed in the ends of this compartment.

NEW ST. LOUIS CAR FOR THE CLEVELAND & SOUTHWESTERN TRACTION CO.

The interior finish of the cars is mahogany, decorated with marquetry lines. The ceilings are of Empire design, painted light green and decorated with gold lines. The deck sash are made in three sections and are glazed with opalescent glass. The end sections are made stationary; the center section is arranged to swing. The car windows are arranged to raise and have a combination Gothic sash, extending over two lower sash, the Gothic sash being made with oval tops and glazed with green opalescent glass.

The framing of these cars is of the company's standard interurban type. The side sills are of one piece of yellow pine, 8 x 5 in., reinforced with a 6-in. steel channel throughout. The center sills are of 6-in I-beams, filled in with yellow pine on each side. The intermediate sills are of yellow pine, 4½ x 6 in. The cross sills are of oak, 3½ x 6 in. The end sills are also of oak, 8 x 5 in. The bolsters are of the trussed-plate type. The side frames are reinforced by a heavy steel plate, back of the letter board, extending the entire length of the car and connected to steel angles and channels in the corner posts, in both the front and rear end of the car.

A hot water heater is placed next to the partition between the baggage and smoking compartments. The control apparatus is located in the front end of the baggage compartment and a heavy pipe guard is used to prevent the baggage falling against the motorman. The cars are mounted on the St. Louis Car Co.'s M. C. B. No. 61 trucks, with rolled steel wheels and spiral journal bearings. The trucks are machine finished throughout. The car equipment also includes air brakes, air sanders, a vertical brake wheel, and a toilet room in the main passenger compartment.

The Indiana Union Traction Co. has announced that beginning with the current year it will carry free 150 lb. of baggage and charge for excess weight about one-fourth the passenger rate.

The New Hampshire Electric Railway Co., Haverhill, Mass., in response to a general demand for coupon mileage ticket books, has placed on sale at various points along its lines such a book, containing coupons for $6 worth of transportation, which is sold for $5. This book is good for the use of any person holding and presenting it for fare and for the use of any number of persons and will have no limit of expiration. The minimum amount of this transportation accepted will be two coupons. The book is good on cars of all lines controlled by this company.

The Single-Phase Electric Locomotives and Power Equipment of the St. Clair Tunnel Company.

An arrangement was recently made between the St. Clair Tunnel Co. and the Westinghouse Electric & Manufacturing Co. for a complete electrical installation to operate freight and passenger trains through the tunnel under the St. Clair River, which connects the American and Canadian divisions of the Grand Trunk Ry.

The equipment includes a complete power station, feeder and distributing system, bridge and pole lines with catenary trolley construction, track bonding, transformers for power, light and shop auxiliary apparatus and electric locomotives.

Interest centers largely in the locomotives equipped with the series-wound single-phase motors. There are to be six similar units designed to meet the requirements of the tunnel service. Each will weigh approximately 62 tons and will develop a draw-bar pull of 25,000 lb. on a 2 per cent grade at a speed of 10 miles per hour. It is of the rigid frame type with driving axle boxes held in the same frame that contains the draft gear. It will be mounted on three pairs of driving wheels which will sustain the entire weight, distributed by equalizer bars similar to those used in steam locomotive practice, will have an outside frame supported on semi-elliptical springs, and will be equipped with Westinghouse friction draft gear, M. C. B. automatic couplings, air sanding apparatus, and bumper steps, front and back. The cab will be of sheet steel mounted on a framework of iron which will support both walls and roof.

The principal dimensions will be approximately as follows: Length over end sills, 27 ft. 9 in.; rigid wheel base, 12 ft. 0 in.; width over all, 9 ft. 6 in.; height from top of rail to top of cab, 12 ft. 6 in.; diameter of driving wheels, 62 in.

The operating apparatus will be arranged along the sides of the cab, leaving a free passage-way 3 ft. 6 in. wide the entire length. The cab will be lighted and heated by electricity, arrangement being made to screen the instrument lights while the locomotive is running.

Combination automatic and straight air and "American" driver brakes will be used. The air supply will be provided by a two-cylinder motor-driven air compressor having, with a 5-in. stroke and speed of 190 r. p. m., a capacity of 45 cu. ft. of air per minute. Air reservoirs, signal outfits, whistle, bell with pneumatic ringers, automatic pump governor, tools, instruments, gages, headlights, push poles and other details complete the auxiliary equipment.

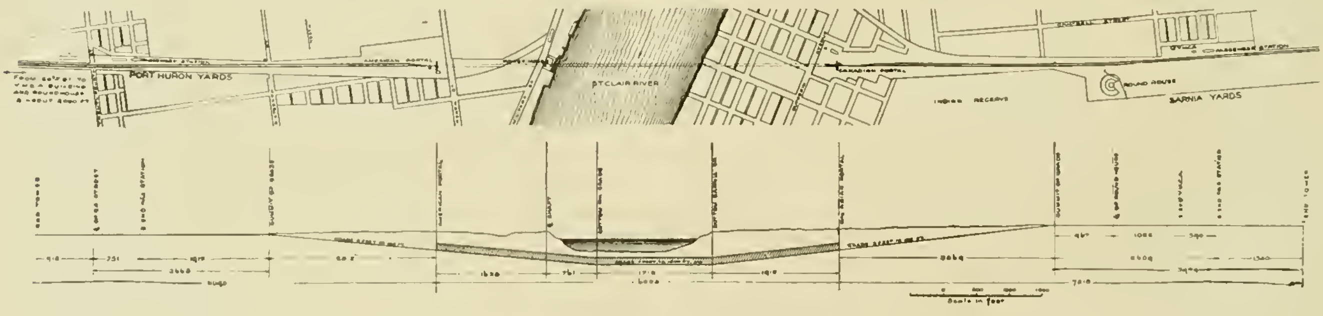
A motor will be geared to each axle, giving each unit an aggregate rated capacity of 750 h. p. The motors will be of the single-phase alternating-current, series-wound, compensating type. They are to be of the same general character as the motors selected by the New York, New Haven & Hartford Railroad Co. for the operation of its line between New Haven and New York. Each motor will weigh complete approximately 14,500 lb., the armature weighing approximately 5,600 lb.

The motor frame consists of a steel cylinder cast in one piece and enclosed at the end by brackets of the same material, which carry the bearings and oil reservoirs. The suspension noses and safety lugs form a part of the main casting. Seats for the axle bearings are cast solid with the frame. All bearings are of phosphor-bronze lined with babbitt and are divided into two parts. They are of exceptionally large dimensions, are arranged for oil-waste lubrication, and are provided with large openings on the low-pressure side, giving a thorough lubrication to the entire bearing surface. Oil is fed into the reservoirs through openings separate from the waste pockets and therefore reaches the waste from below and is thoroughly filtered before entering the bearing.

The motors are swung between the locomotive frame and the driving axles by a flexible nose suspension from two hangers supported by a truck transom and passing through heavy lugs with helical springs above and below the lug. The motors are held to the axle by means of caps which are split at an angle of 35 degrees with the perpendicular, so that the greater part of the weight is borne by solid projections from the motor frame which extend over the axle rather than by the cap bolts. Large openings above and below provide access to the commutator and brush holders.

Within the cylinder of the motor frame there is built up a core of soft steel punchings, forming a complete laminated field. The punchings are dovetailed into the frame and clamped between end rings of cast steel. The field coils are wound with copper strap insulated between turns and about the coils by mica and finished by taping and dipping, and are impregnated with the best grade of varnishes, providing a sealed coil which can withstand the most severe internal heat and is practically indestructible under the usual conditions of heavy railway service.

In addition to the main coils the field carries a neutralizing winding which consists of copper bars placed in the slots in the pole faces and joined at the ends by connectors of copper strap, so as to form one continuous winding which is connected in series with the main field winding and with the armature circuit. The magnetizing effect of this auxiliary winding is directly opposite to and neutralizes that of the armature winding, thus eliminating the effect of armature reaction and improving commutation and power factor. The main coils can easily be removed without disturbing the auxiliary winding.



MAP AND PROFILE OF ST. CLAIR TUNNEL WHICH IS TO BE ELECTRICALLY EQUIPPED.

The armature cores are formed of slotted soft steel punchings built up upon a spider and keyed in place. The spider is forced upon the shaft with heavy pressure and secured by a steel key. Coils of copper strap are embedded in the slots and joined to form a closed multi-circuit winding which is cross-connected, like the multi-circuit winding of a direct-current generator. The basis of the insulation is mica. A preventive winding is connected between the commutator and the main coils, introducing a preventive action which is effective only when the coil is passing under the brush.

During operation a forced circulation of air supplied by motor-driven blowers enters at the rear, distributes itself thoroughly throughout the motor and escapes through the perforated cover over the commutator. This system of forced ventilation of both motors and auxiliary apparatus forms one of the most interesting innovations in electric railway construction. It secures a maximum output from a given weight of material, and a high ratio of continuous output to the one-hour motor rating common in railway practice. It also provides effective ventilation while the locomotive is not in operation, as the blower may be driven while the locomotive is standing at the station or at the end of the line. Motors ventilated in this manner are enclosed and are thereby protected from internal damage by dirt and water and from mechanical injury.

These motors are wound for 240 volts and 25 cycles per second and have a nominal rating of 250 h. p. each, on the basis of usual electric railway practice.

System of Control.

The essential elements of the control equipment include the col-

lecting devices, the auto-transformers, the unit switches, the preventive coils, the reverser and master controllers. A multi-unit system of control is provided with pneumatically operated switches and circuit breakers, low voltage control circuit, and other characteristics standard in Westinghouse practice. Any unit may be controlled from either end, and two or more units may be coupled together and operated from a single cab and by a single crew. The tractive effort which can be readily applied to a single train is therefore limited only by the number of units available, and the hauling power is limited only by the mechanical strength of the coupling between locomotive and cars. A control circuit is carried from one unit to the next by means of connecting sockets and jumpers in the usual manner.

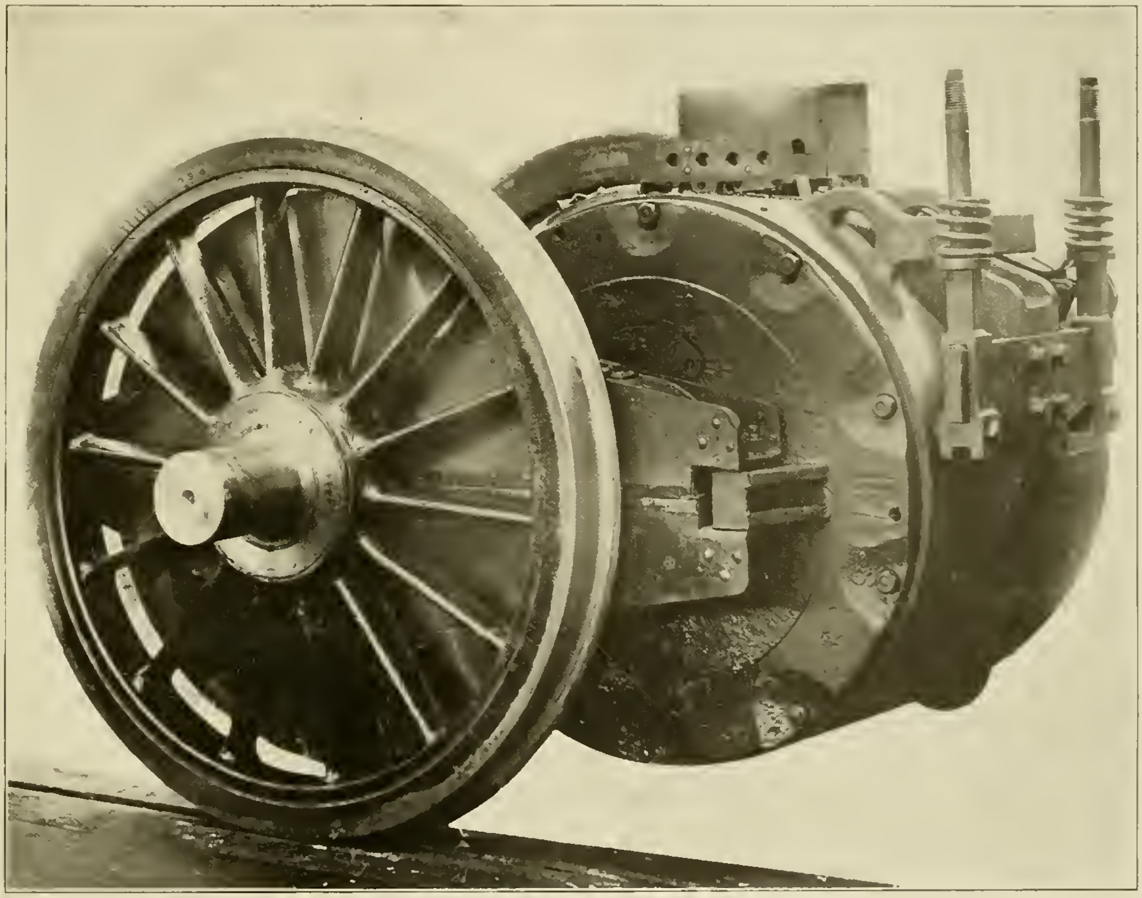
Speed control of the driving motors is secured by variation of the voltage at the motors obtained by means of taps taken from the winding of the auto-transformer which receives current from the trolley at 3,000 volts and reduces it to 240 volts or lower, according to the tap employed. These taps are connected to unit switches from which current is led through the preventive coils to the motors. Four unit switches serve to reverse the field of each motor.

The unit switches are of the manufacturer's standard design. The mechanism is such that a rolling and sliding contact is obtained when the switch closes and opens. The arc is broken at the taps, leaving the contact surfaces smooth. Each unit has a magnetic blow-out coil with laminated core. The switch cylinders are controlled by magnetically operated valves, current for which is obtained from a 50-volt tap from the auto-transformer. The sequence of operation is governed by the master controller in conjunction with a system of interlocks which prevents short circuit of the steps between taps from the auto-transformer or improper operation of the controlling mechanism. At any running point four controlling switches are closed. Through the preventive coils approximately the same amount of current is drawn from each of these switches and the leads to which they are connected. To change to a higher voltage on the motors, the master controller is moved to the next notch, opening the last switch of the group that is closed and closing the switch next higher, with the result that the motor voltage is shifted up one step. By this arrangement the voltage at the motor will be completely under the control of the locomotive driver and may be varied up and down at will without opening more than one quarter of the load current. Small switches in the circuits to the magnets of the reversing switches will enable any motor or combination of motors to be cut out without disturbing the others.

Every one of the seventeen controlling conections provides an efficient running point. This number is ample to prevent any slipping of the driving wheels due to increase of current from one notch to another.

Collecting Devices and Overhead Construction.

Each locomotive unit will be equipped with a pneumatically operated pantagraph trolley to collect current from the overhead lines outside the tunnel and throughout the yards. The proportions of the pantagraph will be such that, when extended, it will make contact with the trolley wire 22 ft. above the rail, and, when closed down, the contact shoe will not extend more than 18 in. above the roof of the locomotive.



VIEW OF SINGLE-PHASE MOTOR MOUNTED ON DRIVER AXLE.

A No. 000 grooved overhead trolley wire will be suspended from a single 5/8-in. steel strand messenger cable by hangers of varying length in such a manner that the trolley wire will be approximately horizontal. The messenger cable will be swung from structural iron bridges located throughout the yards and are of suitable length to span the proper number of tracks. There will also be a small section of track equipped with a trolley line swung by catenary suspension from bracket arms which are supported on lattice-work poles.

Current-Supply.

For the operation of the electric locomotives a complete power plant will be installed by the St. Clair Tunnel Co., including two 1,250-kw., 3,300-volt, 3-phase, 25-cycle, 1,500-r. p. m., rotating field, steam-turbine units with the necessary complement of switchboards, exciters, lightning protective apparatus, etc. This station will also supply current to light the buildings, yards and tunnel, to operate motor-driven centrifugal and triplex pumps which drain the

tunnel and approaches and operate the sewage system, to run motors in the roundhouses and for other purposes.

Operation.

The new equipment will handle that portion of the Grand Trunk Railway system which connects the divisions terminating at Port Huron, Mich., and Sarnia, Ont., on opposite sides of the St. Clair river. The tunnel proper is 6,032 ft. long and the line to be electrically operated measures 19,348 ft. from terminal to terminal.

A pair of the new units will be capable of hauling a 1,000-ton train through the tunnel without division. Mechanical considerations limit the advisable weight of train in the tunnel to these figures. Heavier trains can be divided or sent through together with locomotives in front and behind. The service requires that each unit shall take a train of 500 tons through the tunnel block from summit to summit in fifteen minutes, under the following conditions:

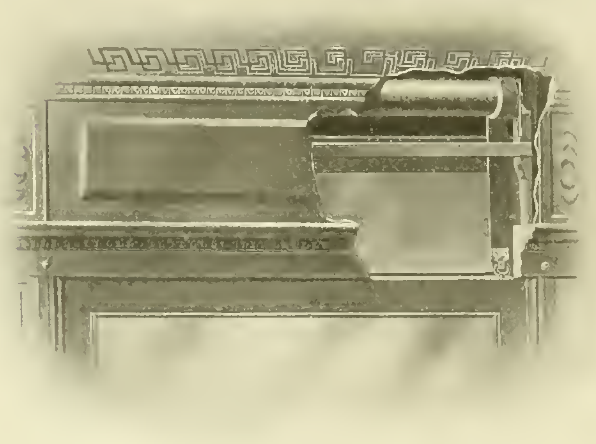
It will be coupled to the train on a level track at a point 1,200 ft. from the summit and must accelerate it up to a speed of 12 m. p. h. in two minutes, at the end of which time it will have reached the summit of the grade leading down into the tunnel. It will then run down a grade of 2 per cent to the level track in the tunnel at a speed not exceeding 25 m. p. h., continue on the practically level stretch under the river, and then draw the train up a 2 per cent grade at the rate of 10 m. p. h. to the level track beyond the tunnel approach on the other side. It must then gradually accelerate the train until a speed of 18 m. p. h. is reached. Each unit must be capable of exerting a tractive effort of 25,000 lb. for a period of five minutes in addition to the energy required to accelerate the train at the starting point and to run with it into the terminal yard, from which point it must immediately run back to a position 1,200 ft. from the summit, couple to another train and be ready to start through the tunnel in the opposite direction. It must therefore make a run of the character described every thirty minutes.

It is expected that the electrical equipment will greatly relieve the traffic congestion now existing and due in a large measure to the necessity of dividing trains at the terminal points, and to greatly simplify the operation of the road. Its opening will mark the progress of electrical methods in the railway field under conditions which seem peculiarly fitted to demonstrate its practical advantages in heavy service. It is interesting to note that the single-phase system has been adopted for so important an undertaking.

The work of installation will be conducted under the supervision of Mr. Bion J. Arnold of Chicago, consulting engineer for the tunnel company, by whom the plans and specifications were prepared.

National Sash Balance.

A device for balancing the weight of window sash, manufactured by the National Lock Washer Co., Newark, N. J., is shown in the accompanying illustration. This sash balance is a specially con-



CUT AWAY VIEW SHOWING NATIONAL SASH BALANCE.

structed spring roller, which is held in brackets at the highest point of the sash slide. Two screw-eyes are placed in the top of the sash, to which are connected belts from either end of the roller. The screw-eyes can be raised or lowered one or more turns to equalize the belts on each side. If a different tension is desired, one belt at a time can be taken off and either wound or unwound on the roller. These belts are attached to the eyes by means of hooks fastened to the ends of small brass straps, the belting being connected to the roller by means of other brass straps locked in grooves. These connections are simple and strong and do not come in front of the glass where an upper sash is used. The sash is thus easily removable and is easy and noiseless in its movement. The tension in the belt is readily adjusted and all wearing parts are made of sheet brass. The balance takes up little room, is placed out of sight, is easily adjusted and is very durable. The advantage over the old cord and weight balance, which necessitated the removal of the sash and a portion of the frame for repairs, is thus readily apparent.

Reversing Direct Current Generators.

BY H. C. REAGAN.

The reversing of compound-wound generators may be occasioned by several means, such as low voltage of the reversed machine when in parallel with other generators, accidental open circuit of the shunt field, slowing down of the engine, or the equalizer switch not being thrown in. In any of these cases the direction of the current flow in the series winding is reversed, overcoming that of the shunt which brings about a reversal of the field polarity. If large units are used, this occurrence when handling a heavy load calls for quick action as the reversed machine must be taken off the line at once.

It may be of interest to describe an accident of this sort which came directly under the notice of the writer. The machines in the station were 5,000 h. p. capacity, three direct-current and two alternating-current three-phase generators, each unit driven by a compound engine. The direct-current generators supplied current to one division of the system, the alternating-current to the other. The alternating distribution circuit fed several rotary converter sub-stations which in turn supplied direct current to the trolley and feeders. The trolley and feeders of the two divisions were tied together and connected with a steam sub-station on another division. Provisions were being made at the time for cut-outs for each section. The arrangements in the power station were these: The two classes of generators were driven by engines supplied with steam from boilers directly connected to each unit, the steam valve being closed in the main header between these sections. This caused a somewhat unbalanced condition of affairs in the fire room. With this situation, it is interesting to note how closely the conditions were studied by some of the firemen because when the valve between the two sections was opened the complaint was made that one fireman played on the other which forced him to do more work than his neighbor. It happened that the valve between the two sections was closed without the knowledge of either of the firemen and at a time when the writer was out on the line. Steam was kept up for a time, but due to a falling off of the steam pressure, the direct-current machines were reversed and the writer was sent for. On noting the condition of affairs he quickly corrected the reversal of the polarity in the following manner:

All the brushes on the direct-current machines were lifted from their commutators and cardboard inserted so that there was no contact. The main switches, with the equalizer left out, were then thrown in and direct current supplied by the sub-stations which were fed by the undisturbed alternating-current distribution system soon restored the machines to the right polarity by flowing through the shunt winding. This same current had of course reversed the machines at the time when the steam pressure fell off and the speed of the engines and the voltage of the direct-current generators was lowered. This method of correcting the polarity of direct current generators has the advantage that there is no need of changing any connections on the board or on the machines, and that it may quickly be brought about if proper care is taken that the brushes are electrically clear of the commutator bars.

The boilers in the plant in question were capable of carrying the entire load that was put on them at the time of this accident but due to the valve in the header being closed, one fireman, who was later dismissed, allowed his steam to get uncontrollably low.

Electrical Equipment of the West Jersey & Seashore Line of the Pennsylvania System.

The proposed electrical equipment of the 64 miles of the old West Jersey & Seashore R. R. from Camden to Atlantic City, N. J., is another step forward in the operation of steam roads by electricity, and will be watched with the greatest interest. Hitherto the electrical equipment of steam roads has been confined practically to terminal facilities and local service over short distances, so that the recent decision of the Pennsylvania R. R. to so equip this portion of its system, will claim the especial attention of the engineering world.

The Cape May line is to be used as far as Newfield, which line is, at present, double-tracked. From Newfield to Atlantic City an additional track is to be laid, making the line double-tracked throughout. Over this double-track line an express electric service will be established. There is to be a three-car train run every 15 minutes and scheduled to make the run from Camden to the coast in 80 minutes without stops. The speed under electrification is to be from 55 to 60 miles per hour. There will also be a local service of two-car trains between Camden and Millville, 40 miles, run on a half-hour schedule, and a ten-minute schedule of single cars between Camden and Woodbury, 85 miles. In all, 58 cars will be operated. The electrical equipment for the cars will consist of two GE-69. 200-h. p. direct current motors. The Sprague-General Electric automatic multiple-unit system of control will be used on these motors.

The third rail system will be used throughout except on the sections between Camden and Woodbury, and Newfield and Millville, where the cars will be operated by overhead trolley, the speed on these sections being less than on the main line.

The power house will be located at Camden. Power for the operation of the cars will be supplied by three 2,000-kw. Curtis turbines. These turbines will be of the three-phase, alternating-current, 25-cycle type and transmission will be made to the sub-stations at a potential of 33,000 volts.

There will be seven sub-stations, six situated on the line between Camden and Atlantic City and the seventh at Millville, to supply the line between Millville and Newfield. The sub-stations will contain rotary converters providing a total capacity of 11,000 kw. and delivering direct current to the third rail at a potential of 650 volts. The individual units will have a capacity of 750 kw. each. They will be started from the alternating-current end by means of taps on the step-down transformer.

It is expected that this road will be completed in time to take care of the coming heavy summer traffic. About $3,000,000 will be spent in the work.

New Cars for the Conestoga Traction System.

The Conestoga Traction Co., which operates an extensive system in southeastern Pennsylvania, the center of the system being at Lancaster, has recently added to its equipment a number of groove-

NEW BRILL CAR FOR CONESTOGA TRACTION CO.

less-post semi-convertible cars built by the J. G. Brill Co. The order included straight passenger cars and combination passenger and baggage cars. The Conestoga Traction Co. has ordered the present lot for a new system known as the Rohrerstown, Landisville & Mount Joy Street Ry., which is 35 miles long. The straight passenger cars recently furnished were for another new division, 8.5 miles long, which has its terminus at Quarryville. The Conestoga Traction Co. has a trackage of 145 miles, with 110 cars in operation.

The illustrations are of one of the combination cars. This design conforms to the standard type which the Brill company builds for interurban service, where it is necessary for cars to pass through the main streets of cities and take on passengers from the pavement or roadside. The new Conestoga Traction Co. cars are mounted on the builders No. 27-G type of truck, designed for a speed of 30 miles per hour, and yet carries the car body low, so that the platform steps are easy to mount. In the illustration of the interior of the passenger compartment several windows are open at the left side, giving a good idea of the neat appearance of the grooveless posts when the sashes are in the roof pockets. Four metal window-lock stops are provided in each post, enabling the

INTERIOR DETAILS OF NEW CONESTOGA CARS.

sashes to be held at suitable heights. There is no cutting into the posts other than for these window-lock stops, and therefore their strength is unimpaired by the grooves which were formerly necessary for the sash runways. The interior of the baggage compartment is furnished with folding seats for the use of smokers. The sliding side door construction and other details are of the builders' usual design.

The cars measure 30 ft. 8 in. over the bodies and 40 ft. 1 in. over the vestibules; the width over sills, including panels, is 7 ft. 10½ in. and over posts at belt 8 ft. 2 in.; height from track to under side of side sill, 2 ft. 8¼ in., and from this point over monitor deck, 9 ft. 2¾ in.; from top of floor to top of molding on window sill, 25 in.; height of window opening, 3 ft. 6⅜ in.; width of double-door opening at vestibule end of passenger compartment, 40 in.; width of sliding door opening at side of baggage compartment, 40 in.; door openings in partition and at platform entrance of baggage compartment, 27 in.; from center to center of body bolsters, 17 in.; height from track to tread of platform step, 16½ in.; from step to platform, 14½ in., and from platform to car floor, 8 in.; centers of side posts, 2 ft. 8 in.; size of side sills, 4¾ x 7¾ in.; end sills, 5¼ x 6⅞ in., and sill plates on the inside of side sills, 12 x ⅜ in.; thickness of corner posts, 3⅝ in. and side posts, 3¼ in.

The seats, which are of the builders' manufacture, have high backs with head rolls, are upholstered in spring cane and have 36-in. cushions. The aisles are 22-in. wide. The interior of the passenger compartment is finished in mahogany, rubbed to a dull gloss, with birch veneer ceilings painted robin's-egg blue and decorated in gold. The heads of the posts are neatly carved and the paneling inlaid with a strip of holly. The interior of the baggage compartment is painted lead color and the ceilings are carline finish. The cars are equipped with channel-iron draw bars, sand boxes, platform gongs, signal bells, brake handles, angle-iron bumpers, vestibule folding door controllers and other patented specialties of the builders' manufacture. The wheel base of the truck is 4 ft., and the track gage 5 ft. 2½ in.; diameter of wheels, 33 in. and diameter of axles, 4 in. Four 40-h. p. motors are used on each car.

The new gasoline-electric cars of the Chicago & Alton Ry. have been tested and will soon be put into service.

Signal System of the Underground Electric Railways Co. of London.

Rapid progress is being made in carrying out the plans for equipping the underground railway system of London for electrical operation, and in connection with this work there are several features of especial interest. In this article it is proposed to describe the signal system adopted by the Underground Electric Railways Co. of London (The Yerkes' company) for the control of trains on the Metropolitan District Railway.

The first section of line, that between Hanger Lane Junction and South Harrow, has been worked electrically by the District railway for considerably more than a year, with results that promise well for success on the more important sections of the line. The length of this trial section is about five miles of double track, and it is divided into block sections, varying in length from 1,400 ft. to about 3,500 ft. On the District railway generally there are both positive and negative insulated conductor rails, the running rails not being used for the power current. The space between stations is usually divided into two blocks, that is, a "starting" and a "berth" block, and the signaling is on the "normal clear" principle.

The signals themselves are of the ordinary mechanical type, and in no way specially adapted for power or automatic working; consequently they are being replaced by special arms with Westinghouse electro-pneumatic signal motors fitted close under them, and the ordinary counterweight abolished for one directly on the signal arm. The motors are enclosed in cast iron casings, and are not affected by climatic conditions. They are controlled by small pin valves worked by means of electro-magnets in the local signal circuit. Signal cabins are required only at each end of the branch, or where there is a cross-over road.

An automatic stop prevents trains from overrunning home signals. This stop, which is shown in an accompanying illustration, consists of an iron arm between the track rails actuated by a compressed air motor acting in unison with the adjoining signal motor. When the signal goes to "danger" this arm is elevated to a position in which it engages with a cock on the air brake system of the train; thus the brakes are instantly and automatically applied if, for any reason, the motorman should run past the signal.

No great saving in first cost need be expected from an automatic installation, as the intitial expenditure would probably be quite as great as that incurred in laying down the mechanical system. The working expenses, on the other hand, should be very much reduced, the saving in labor being a most important item, and the cost of renewals and repairs trifling. But undoubtedly the greatest advantage of an automatic system is its suitability to the requirements of a very frequent and quick service. The blocks may with facility be made as short as is compatible with the running speed and braking power of the trains. The strain on the signalmen, inseparable from such a service, is abolished.

The principles of the system may be understood by reference to the accompanying diagram. One of the track rails is electrically continuous through the whole length of the installation, and constitutes the positive conductor from the generator to the individual track sections. The other rail is cut up into block sections by means of special rail joints insulated with fiber. All uninsulated rail joints are bonded to insure electrical continuity. Current for the operation of the system is generated at 65 volts by motor generators placed centrally, the negative terminals of which are connected to an insulated negative main running the entire length of the system. This main is connected to each section of the sectionalized track rail at a point near the end of the block at which the train leaves. It will be seen, then, that there is a potential difference of approximately 65 volts between the continuous positive rail and the insulated negative main.

Resistances are interposed in the connections between the negative main and the sectioned rail which reduce the potential difference between the rails to, in the present instance, from 3 to 6 volts, according to the length of the block and various local conditions.

The circuit for a single block unoccupied by a train is as follows: The current from the positive brush of the dynamo flows along the continuous rail, and thence through the two relays, one at each end of the block, and through the ballast between the rails, all in parallel, to the sectioned rail. From this it flows through a relatively large resistance to the negative main and back to the machine.

Suppose a train enters the block. The current now flows through the practically negligible resistance of the car wheels and axles from one rail to the other, and the relays are shunted, with the result that the signal is allowed to fall to danger.

The "track battery" resistances connected between the negative main and the sections of the sectionalized rail prevent the generator being short-circuited when the track circuit is shunted by the axles of the train. In fact, these resistances bear such a relation to the combined resistance of the roadbed from rail to rail and the two relays, all in parallel, that the shunting of the track cuts out only a small percentage of the total resistance of the circuit. Thus the current increase in a circuit when shunted is not great; this is important, as it is advisable to keep the track potential as nearly constant as possible. An increase of the total current, resulting from the blocks being occupied by trains, affects the potential between the rails of unoccupied sections, increasing the transmission loss in the negative main. The loss in the continuous track rail may generally be neglected on account of its large section.

Another circumstance directly affecting this track potential is the variation of the resistance of roadbed according to weather conditions. Broken stone forms much the best ballast from an electrical

VIEW SHOWING TRAIN STOP, THIRD AND FOURTH RAILS.

point of view, and cinders the worst. It may here be mentioned, that though on several recent occasions the track rails on this system have been flooded, it is reported that the operation of the signals has been in no wise interrupted.

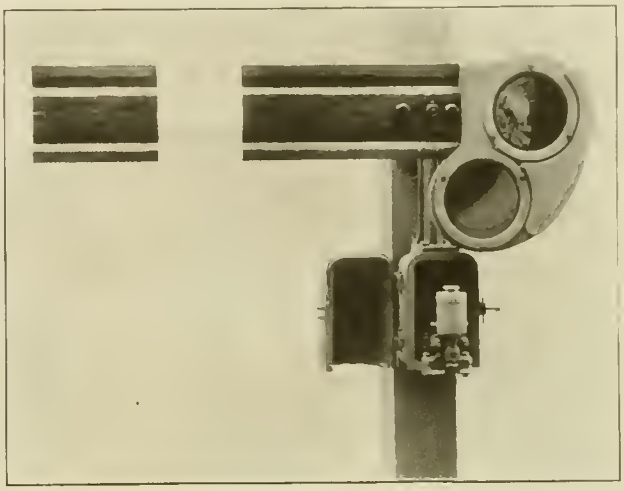
In the accompanying diagram are shown the circuits of the track relays which control the signal circuits. This is a diagram of the relay and signal magnet circuits for a single block. The track coils of the relays are permanently connected across the rails at that end of the block at which the relay is placed. Between the pole pieces a polarized armature is suspended from a pivot. This armature bears a winding of considerable resistance, and is connected between the positive rail and the negative main through a contact, operated by the track coil armature, which contact is closed when the track coils are energized. To the polarized armature is rigidly connected an arm which actuates a contact, the function of which is to open or close the local circuit controlling the signal motors. The operation of the relays is then as follows: When a difference of potential exists in the normal direction between the rails, that is, when there is no train on the block, the relay track coils are excited and draw up the armature, which closes the circuit through the polarized armature. The polarized armature is then attracted to one of the poles of the relay, and swinging over, closes the contact in the local signal circuit.

As already mentioned, there are two relays in each block, one at each end; these are duplicates, and operate normally in a precisely similar manner, each working a contact in the local signal circuit. These contacts on relays A and B are in series, as shown in the diagram of circuits, and unless they are both closed no current can flow through the signal magnet, and the signal will therefore remain at "danger" by gravity.

The position of the apparatus when the block is empty has been described; both relays energized, the local signal circuit closed, and the electro-magnetic valve operating the pneumatic signal motor consequently open, admitting compressed air to the motor, which holds the signal arm "off." As soon as a train enters the block, the relays are short-circuited by the car axles and thereby de-energized, permitting their armatures to drop, and thus breaking the circuit through the polarized armature coils. The polarized armatures then swing back from their position in contact with one of the track-coil pole-pieces, and in doing so break the signal circuit at two points in series. The electro-magnet operating the admission and exhaust valves of the pneumatic signal motor is de-energized, and the exhaust is opened, permitting the signal to return to "danger" by gravity. It is a canon of successful automatic signaling that any interfering influence must, if it has any effect at all, cause the signal arms to go to "danger," and not bring them "off."

closest attention on account of the disorganization of the traffic which they may cause, but even if they were rare, the least liability to give false signal indications of safety would forfeit all claims for consideration.

Although in the present system it is possible for the extraneous currents to energize either one or both relays while the train is in the block, these latter are so interconnected that it is not possible



SEMAPHORE AND ELECTRIC MAGNETIC MOTOR.

for them both to be energized in the normal direction at the same time by extraneous currents.

The various conditions which may occur with a train in the section may be catalogued thus:

Both relays shunted, no extraneous current. (Normal.)

One relay shunted, the other energized normally. (Signal circuit broken at one point.)

One relay shunted, the other energized reversely. (Signal circuit broken at two points.)

Both relays energized, one normally and one reversely. (Signal circuit broken at one point.)

The circuit through the signal magnet is designed to be always open at one point when a train is in the section, and often at two.

The only parts of the mechanism which can be described as in any way delicate are the relays, and these are enclosed in weather-

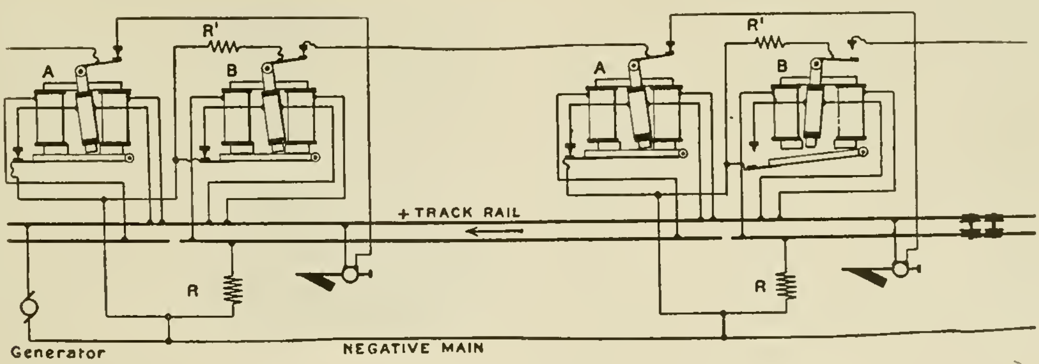


DIAGRAM OF CONNECTIONS FOR AUTOMATIC SIGNALING.

Experience has shown that the greatest obstacle to the success of automatic signaling, on electric railways in particular, is the liability of the relays being operated by extraneous currents so as to cause a false "clear" indication when danger should be shown. The particular claim of the system under consideration is that it is impossible for an extraneous current, from whatever source, to bring the signal arm to the "off" position when it should stand at "danger."

The main source of extraneous currents affecting the signals is the 500-volt traction power circuit, and when, as is the case at Ealing, the track is not used as a return, the presence on the block sections of current from this source is abnormal. Faults in the main power circuit occur with sufficient frequency to demand the

proof boxes, where they can be examined readily at intervals. The air pressure used is about 70 lb. per sq. in., which enables compact motors to be used for signals, points, stops, etc. It is reported that the air motors used, work year in and year out without giving the least trouble. The piping is compact, the electrical wires few and small, and the alterations to the track of a trifling nature. The system is applicable where track return is used with either third rail or overhead trolley wire.

The signal motors, relays and other special apparatus were manufactured at the London works of the Westinghouse Brake Co. and supplied direct to the Underground Electric Railways Co. of London, which installed the apparatus.

The Circle Swing for Amusement Parks.

The circle swing has proved a popular attraction of many amusement parks, and we present herewith an illustration of a swing, a description of which may prove interesting to operators of such parks.

The swing presents some new features. The tower is a steel structure of gusset plate bridge construction, thoroughly braced and anchored to the foundation. Over the top of this structure is telescoped a six-armed, cantilever, steel crown truss, in such a manner that the entire weight of the cars, passengers and crown truss is carried from the under side of the top supports, while the lower part of the crown truss, to which the gear wheel is attached, is provided with anti-friction roller bearings to guide it while revolving. This crown truss with its load is supported on 154 one-inch steel balls traveling between two case hardened, ground steel plates. Each ball is made to travel in its own individual path, reducing friction to a minimum.

THE CIRCLE SWING.

A 36-passenger swing, when loaded, requires but a small amount of current to operate it. A 7½-h. p. motor is located in the top of the tower, directly under the crown truss, and is connected by a cut gear and rawhide pinion to the crown truss gear. The swing may be brought to full speed in less than 60 seconds, and while no brakes are used, yet, with the aid of a special controlling device the swing may be brought from full speed to a dead stop without a jar in 30 seconds.

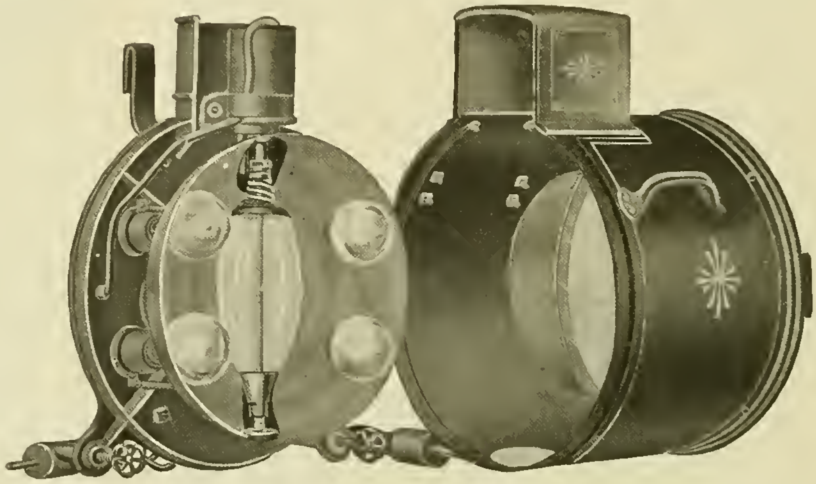
The structure weighs 11½ tons, and is so designed that the safety of the passengers in no way depends upon any part of the machinery. The manner of telescoping the crown truss over the tower prevents any possibility of accident. The controlling and driving mechanism of this swing is self-regulating to the extent that no careless act of an operator, in suddenly throwing on or off the current, could in any manner affect the safety of the passengers or structure.

This park attraction is placed on the market by the Federal Construction Co., Chicago, Ill., which claims for it favorable comparison with similar designs in safety, strength, durability, economy of power and attractiveness.

A Combination Arc-Incandescent Headlight.

In choosing a headlight for interurban cars which operate at high speeds over private right of way, and at slower speeds through cities, there are several points of construction which should be well considered. The headlight should be of such design that it will maintain a steady arc and clearly illuminate both rails for some distance ahead of the car. When city streets are reached it is desirable that the intense light of the electric arc either be dimmed or some less powerful substitute used.

In order to meet these conditions the "Climax" headlight has been designed and is furnished to the trade by the Trolley Supply Co., Canton, O. We present an illustration of the headlight, showing the cover moved away and the arrangement of the incandescent and arc lamps. The construction of this piece of apparatus is mechanically substantial and from previous experience, the design of the late type has been perfected so that its operation is highly satisfactory. The current consumption of the arc is about 1.5 amperes. In order to facilitate the changing from one kind of lamp to the other, two positive connection plugs are provided, the negative connection to the car circuit being made through the lamp hangers. Such a change can also be effected by the alternative method of using a two-point switch, placed in the vestibule of the car.

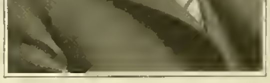


THE CLIMAX COMBINATION HEADLIGHT.

As the current can easily be switched over so as to furnish either a bright arc light or the less glaring incandescent light, no curtain or screen is required for dimming when operating over city streets. The reflector which projects the beam of light has a so-called double-parabolic shape.

Charles T. Yerkes.

Charles T. Yerkes, millionaire traction magnate, creator of the Chicago Street Railway system and builder of London's Underground R. R., died on the afternoon of December 30, 1905, at his New York apartments. Mr. Yerkes' death was due to kidney disease and heart trouble and had been expected for some time, but the end was unexpectedly sudden.



CHARLES T. YERKES.

Speyer & Co., the New York banking firm which had much to do with the local financing of Mr. Yerkes' affairs, has made the following statement: "The death of Mr. Yerkes is is particularly sad, coming at a time when his great work in connection with the London Underground R. R. was rapidly approaching completion and important portions of it were being put in operation. Mr. Yerkes' failing health had warned him and the bankers associated with the enterprise, that arrangements should be made for relieving him of a portion of his work, or for completing and carrying it on in case of his death.

Mr. Yerkes was born of Quaker parents in Philadelphia, June 25, 1839. At the age of 15 he secured a position as an office boy, and at 17 he went into the commission business. Four years later he started independently as a broker. Mr. Yerkes operated in Philadelphia with more or less success until the time of the Chicago fire of 1871, which entailed heavy losses in eastern money circles. He was forced to make an assignment.

Before his failure, Mr. Yerkes had speculated in Philadelphia street railways and had made considerable money. He organized the Continental Passenger Ry. and sent the stock up from $15

to $100 a share. Then occurred the Jay Cooke failure from which he cleaned up from the short side of the market enough to pay all his debts. He resolved to seek a new field for street car operations and in 1875 went west.

At the age of 36, Mr. Yerkes passed through Chicago and finally located at Fargo, S. D., where he organized a land syndicate, making and losing considerable money in various speculations He was 42 years of age when he came to Chicago in 1881 He started business as a stock and grain broker and steadily made money, all the time watching for opportunities for investment in street railroads.

In May, 1886, he secured control of the North Chicago City Ry. and organized it into the North Chicago Street Railroad Co. He paid for his control of the road with money raised from the mortgage on the property itself, and it has since developed that practically he never invested any of his own capital in the enterprise.

Two years later, he organized the West Chicago Street Railroad Co. out of the old West Division Street Ry. in a similar manner. Immediately after this he set about expanding the north and west side systems to the city limits with trolley lines, later organized as the Consolidated Traction Co. By the time of the World's Fair Mr. Yerkes was the greatest street railway magnate in the West. Several years later he turned his attention to elevated railways, gaining control of the Lake St. and then organizing the Northwestern and the Union Loop companies.

In July, 1889, Mr. Yerkes sold practically all of his interests in the north and west side companies to the Union Traction Co. He realized from the sale about $20,000,000 besides bonds of the Consolidated Traction Co. to the amount of $6,000,000. In February, 1901, the sale of his interest in the Lake Street, Northwestern, and Union Loop Elevated Rys. was announced for a total sum of $4,000,000. In addition he sold to Thomas F. Ryan, representing the Whitney-Widener-Elkins syndicate, his remaining interest in the Union Traction Co., amounting to $1,000,000. At this period Mr. Yerkes moved to New York, where he engaged in the building and furnishing of his $4,000,000 mansion.

In 1902 Mr. Yerkes went to England to give his whole attention to the last great enterprise of his life. His ambition was to get possession of the underground transportation facilities of the British capitol. A syndicate was formed for a comprehensive underground system, in which electricity should be the motive power, in place of steam. The syndicate bought a franchise for $5,000,000 and began work on the new system.

On June 6, 1901, the syndicate secured control of the Metropolitan District Ry. Improvements on a great scale were announced at once. New bores were run, and the equipment changed from steam to electricity as far as possible.

Mr. Yerkes was ambitious to become master of the entire London underground field, and in his efforts along this line he became engaged in a long and bitter controversy with the Metropolitan Railway Board. As the struggle progressed Mr. Yerkes and his syndicate put in more and more electric lines, and the Underground Electric Railway Co. was organized to take over several smaller concerns. The company had a capital of $25,000,000. There began to appear, company on company, bond issue on bond issue, and all the bewildering fabric of financial companies.

Thus the work of Mr. Yerkes now stands in London. It is estimated that it will take $75,000,000 to complete needed additions to the existing systems that were under his control. Mr. Yerkes gave the city of London vastly better transportation facilities than it enjoyed before his advent. A marvelous amount of work has been done and apparently well done.

In speaking of the personal traits of Mr. Yerkes, John M. Roach, general manager of the Union Traction Co. of Chicago, pays him the following tribute:

"He was always kind, courteous and considerate to his employes. He was generous and charitable, but never paraded the fact. There was nothing in Mr. Yerkes but good. Anything else was forced from him by conditions. Mr. Yerkes was not ambitious to be a millionaire, but he was ambitious to be known as the foremost traction man in the country, and I think he was."

The Detroit-Bay City Electric Co. is now ready to begin the laying of steel on the new line projected from Bay City to Detroit. About 10 miles of road have been graded and the construction gang is being continually enlarged.

The Modern Amusement Park.

The interest displayed in the modern amusement park by the public from year to year continues, and the returns from the investments vary, depending largely upon the selection of locations for grounds that can draw the people from the thickly populated sections to the park in a convenient and speedy manner. Amusement parks offer substantial sources of revenue to the traction companies operating them as terminals of their lines. The number of parks operated by electric railways is steadily increasing and nearly every city of a sufficient size to warrant a street railway system has its amusement parks. Such parks are found to contain no objectionable features. This is shown by the fact that their patrons include both women and children.

To make resorts of this character pay, considerable thought must be devoted to their construction. Among those with wide experience in the designing, erecting and operating of amusement parks is the Edward C. Boyce Co., of No. 302 Broadway, New York City. This firm, of which Mr. Edward C. Boyce is the president, is prepared to organize corporations and furnish all or a portion of the necessary capital to establish these parks throughout the country. A large permanent staff of expert superintendents, draftsmen and mechanics is maintained by this firm to execute the details of construction. It has been found by experience that too much attention cannot be given to the selection and arrangement of devices, and the experience of these men will, undoubtedly, do much to insure success and keep the cost of construction at a minimum.

The firm's services include expert advice and the benefit of exceptional resources on all questions of this particular line of architecture. The general system of operation employed is to lease ground for small attractions, the company, or owner, however, operating all the larger or principal features.

GENERAL VIEW OF "THE WHITE CITY," CHICAGO.

During the year just past, the firm mentioned has accomplished considerable important work. "The White City," Chicago, at present one of the largest amusement parks in the world, is a creation of this firm. It also has constructed parks in Cleveland, O,: Worcester, Mass.; New Haven, Conn., and Portland, Ore., each known as "The White City." Numerous other individual devices throughout the country are included in the year's work.

Some idea of the magnitude and profit of such enterprises may be conveyed by the statement that one resort erected by this firm during the season of 1905, costing a little over $600,000, returned a net profit of about $500,000 as the result of the first season's operation. Another, and smaller resort, earned a net profit of 60 per cent of its gross cost, and brought about an increase of 21 per cent in the receipts of the local street railway.

We quote from a recent interview with Mr. Boyce, who, in speaking of the marvelous growth of this comparatively new line of architectural work, said: "Few understand the magnitude of the work of building summer amusement parks. It has been stated that today there are more than 970 summer amusement parks in the country. Each month shows an increase, and scores are being constructed at the present time. Some of these parks, possibly three or four, cost the promoters, irrespective of land purchases or leases, not less than $1,000,000 each. Three or four others approximate in value $500,000, and twenty or thirty range in value from $50,000 to $250,000.

"The World's Columbian Exposition opened the eyes of the people, who since then are not content to go to parks that hold out for them no attractions other than suburban scenery and rural surroundings. The people desire to visit the more exciting amusements and listen to orchestras and open-air band concerts. And a park is far from modern standards if it lacks restaurants and dancing pavilions."

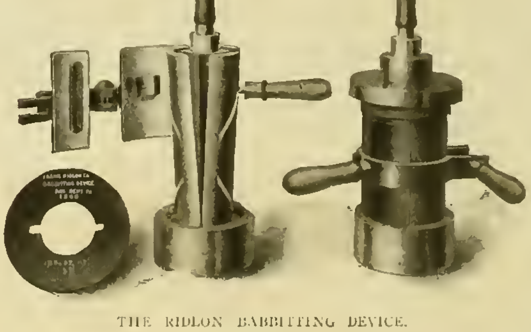
GENERAL VIEW OF "THE WHITE CITY," CLEVELAND.

It will surprise many to learn of the great number of parks in the country, of the vast sums of money invested in their construction, and the likewise large amounts which are spent each summer by the amusement-loving men, women and children. When such figures are learned, then the magnitude of these amusement departures is comprehended.

The Ridlon Babbitting Device.

A satisfactory device for casting babbitt should be composed of but few parts and these of substantial design. The more or less frequent need of renewing the babbitting upon bearings calls for a device which will accurately and easily mould the babbitt metal to a close fit with the journal which it supports. Such a device is being placed on the market by the Frank Ridlon Co., 200 Summer St., Boston, Mass., an illustration of which is herewith presented.

The device consists of a center core mounted upon a substantial base. Around the center core is placed a form for moulding the babbitt metal into a suitable shape. It is provided with a collapsible arbor, as shown, which is broken down by removing the center core. The different parts of the device are fitted with handles so that these parts may be re-adjusted for a second use while they are still hot. In casting with this device the ends are squared and the oil holes and oil ways are finished in the babbitt by the one operation.



THE RIDLON BABBITTING DEVICE.

STREET RAILWAY REVIEW

Vol. XVI | FEBRUARY 15, 1906 | No. 2

Street and Interurban Railway Parks.

Being the Description of a Large Number of Amusement Resorts Served by Electric Railways.

TOBOGGAN SLIDE AND BATHING PAVILION, WILDWOOD PARK, WHITE BEAR LAKE, MINN.

PAVILION, REAR OF BALL GROUNDS AND STREET RAILWAY LOOP, COLUMBIA GARDENS, BUTTE, MONT.

Twin City Rapid Transit Co.

Wildwood is situated on the shores of White Bear Lake, 12 miles from St. Paul and 22 miles from Minneapolis, on a typical Minnesota lake, four miles long and two miles wide. It is conducted on the principle that pleasure seekers appreciate a well-governed resort free from rowdyism and objectionable features but at the same time offering plenty of amusement. Wildwood is a park of 75 acres, owned by the Twin City Rapid Transit Co., and under the management of H. M. Barnet, the lessee.

Fishing, boating, bathing and every form of water sport can be had at Wildwood. Eighty row-boats of the most improved pattern are in constant commission and, if the pleasure seeker wishes to try his luck with the White Bear fish, tackle and bait can be had at the Wildwood docks. Near the beach is situated a 260-room bath house equipped with the most modern facilities for the comfort of bathers and there is also a 100-ft. water toboggan.

There are eleven buildings on the grounds. In the central building, a spacious pavilion, is the dancing hall and a complete cafe and soft drink counter. Here the visitor can get everything from a dish of ice cream to a course dinner. Back of the pavilion, stretching along the grounds, are the amusement features. Among these are an eleven-alley bowling pavilion, a laughing gallery, a Katzenjammer castle, a Hooligan slide and the ever popular figure-eight toboggan with its exciting turns and twists.

In addition to the permanent features at Wildwood the management offers each year features of a transitory nature. An orchestra plays for dancing every afternoon and evening, acrobatic acts are occasional features, and during last season firework displays were given twice each week. These displays were given under arrangements with B. E. Gregory of Chicago and included novel and original features on the surface of White Bear Lake. They proved the best free attraction ever offered at Wildwood.

Mr. Barnet has not decided what improvements will be made in the park this spring or what special features he will offer his patrons during the coming season, but it is probable that an old mill will be installed as one of Wildwood's permanent amusement devices.

The success of Wildwood is due in a large measure to the policy adopted by H. M. Barnet when he assumed the management of the park. Mr. Barnet believes that the reason amusement parks are not more generally successful is found in the fact that too much attention is paid to the pavilion feature and that the other devices are neglected. He believes that with one man in control of a park it can be conducted on lines that will merit public patronage and he makes it a personal matter to see that picnic parties, especially ladies and children, receive courteous treatment at Wildwood. That the plan has succeeded is shown by the fact that when Mr. Barnet took control of the park, liquor was sold on the premises and the rowdy element predominated while now Wildwood has become generally recognized as a place where ladies and children may go with perfect safety and where the objectionable features of the amusement park have been entirely eliminated.

Butte Electric Railway Co.

Those who are familiar with the country about Butte, Mont., and with the sulphur-laden fumes that come from the great copper smelters there will find it hard to realize that a garden or any growing plant could be maintained amid such surroundings. For this reason Columbia Gardens, while it presents nothing of an unusual nature to the Eastern mind, is particularly attractive under the conditions in which it is maintained. The park is located at the foot of the main divide of the Rocky Mountains, four miles from the center of the city of Butte. It is owned and operated by the Butte Electric Railway Co., which has a double-track line between the city and the gardens.

One of the most popular features of the gardens is the hothouse, in which a great variety of flowers and plants are grown. There are no flowers in the city of Butte for the reason which we have mentioned, and admirers of this form of nature can here gratify their tastes. In connection with the hothouse, there is a large pansy bed, in which during the past season 15,000 pansy plants were grown. Ladies are allowed to pick these flowers every afternoon.

There is no theater in connection with the park. There is, however, a large dance hall, which has a floor 80 x 130 ft. in size, constructed of grained hardwood. The usual amusements are operated, including a roller coaster, a shooting gallery, a merry-go-round and shoot the chutes. There are also a well-stocked zoo and a fish hatchery with a capacity of 1,000,000 trout. Another popular feature of the gardens is the band of the Boston & Montana Mining Co., which gives well-selected concerts from time to time. Frequently small tribes of wandering Indians are engaged, and pitch their tents in the gardens, giving their dances and games, which are much enjoyed by the public.

No admission is charged to the park, and twice each week all children under sixteen years of age are carried to the grounds free, as the guests of Senator W. A. Clark, the president of the railway company.

Portland & Brunswick Street Railway Co.

Casco Castle is situated on a high bluff 100 ft. above the sea and 300 ft. from the waters of Casco Bay, which surround it on three sides. This resort is one of the most popular on the Maine coast, and visitors from New York, Boston and other points are attracted thither each year by the beauties of picturesque Casco Bay. Although the grounds upon which the castle is built are operated by the Portland & Brunswick Street Railway Co., the resort is rather different from the usual type of park controlled by a street railway company.

Casco Castle is a large and handsome hotel equipped with all the conveniences of the modern hostelry. The grounds surrounding this hotel comprise 50 acres, lying along the seashore, part of which is heavily wooded, while the portion in the immediate vicinity of the hotel has been further beautified by landscape gardening.

Casco Castle is just outside the old town of South Freeport, which is two miles from Freeport and 12 miles from Portland, Me. Freeport is reached by the Main Central R. R., connection for the Castle being made there with the Portland & Brunswick Street Ry. South Freeport is also reached by steamboat lines from Boston and Portland, and the sail through the 365 islands of Casco Bay is particularly delightful.

The management conducts its advertising entirely by souvenir postal cards, which are sold to visitors and afford a substantial revenue for the park. The cards bear a picture of Casco Castle in several colors. Last season 37,700 of these cards were sold and distributed to all parts of the country, which is an original way of combining an advertising and at the same time a money-making scheme.

Toronto & York Radial Railway Co.

The Toronto & York Radial Railway Co. owns Bond Lake Park, which is picturesquely situated among the hills 20 miles from the city of Toronto, Canada. There is no theater in connection with the park, the natural attractions being depended upon mainly to furnish amusement. There are baseball grounds, a dancing pavilion, swings, good boating facilities and other attractions of a similar nature. The company controls all the attractions with the exception of the refreshment and boating privileges, which are leased. The park is managed by the traffic department of the railway company.

San Diego Electric Railway Co.

Mission Cliff Park belongs to and is operated by the San Diego Electric Railway Co., and is about three and a half miles from the city of San Diego, Cal. The principal attraction of the park is its unique situation and the varied and picturesque character of the surrounding scenery. It is located along the top and side of a steep bluff overlooking Mission Valley, which lies nearly 400 ft. below. The view to the north includes the Los Angeles and San Bernardino mountains, 130 miles away, while to the west is seen the Pacific, with San Clemente Island plainly visible at a distance of nearly 100 miles. Fifty miles to the eastward is the Cuyamacca range, while to the south the mountains of Lower California stretch away into the distance.

Though the charm of Mission Cliff Park lies chiefly in the

ATTRACTIONS AT WILDWOOD PARK, WHITE BEAR LAKE, MINN.

CHILDREN'S PLAYGROUND, COLUMBIA GARDENS, BUTTE, MONT.

CASCO CASTLE, SOUTH FREEPORT, ME.

BOAT HOUSE, BOND LAKE PARK, TORONTO, CANADA.

PAVILION, MISSION CLIFF PARK, SAN DIEGO, CAL.

natural beauty of the situation, it is not without other attractions. There is a pavilion 80 x 140 ft. in size, surrounded by a wide veranda and containing a dance hall, lunch rooms, etc. The company at present provides no special amusements, but places the park and pavilion at the service of the public free of charge. Parties who desire the exclusive use of the dance hall in the evening pay a small charge to cover the cost of lighting. Further improvements and the extension of the park boundaries are contemplated by the company and will be carried out at an early date.

A feature which merits special mention is the well-equipped ostrich farm, which occupies the eastern end of the park and is a source of interest to all visitors.

Kankakee Electric Railway Co.

Electric Park is owned by the Kankakee Electric Railway Co. and is operated by the lessee and manager, Chas. W. Burrill. It is located on the banks of the Kankakee River, about two miles from Kankakee, Ill. The park now contains a theater seating 1,000 people, but a new one is to be built during the coming season with a capacity of 1,500. A dramatic stock company has given performances at the theater with special vaudeville features between the acts, and this form of entertainment has been found very remunerative. There are also a dancing pavilion, bowling alleys and bath houses, also a merry-go-round and other small amusements.

CHARLES W. BURRILL.

A boat landing will be built on the river and steam launches and row-boats will be kept on hand. Band concerts are given every afternoon and evening. The lines of the Kankakee Electric Railway Co. have recently been entirely rebuilt and new cars added to the equipment, so that transportation facilities to the park are of the best.

Parks of the Indiana Union Traction Co.

The Indiana Union Traction Co. operates three parks in connection with its railway system, which are known as Broad Ripple Park, Indianapolis, Ind.; West Side Park, Muncie, Ind.; and Mounds Park, Anderson, Ind.

Broad Ripple Park is located about seven miles from the city of Indianapolis, on the banks of White River. It is now operated by an amusement company which is building a "White City" there. The park contains a variety of amusement devices, such as the figure-eight roller coaster, merry-go-round, etc., and a summer theater in which vaudeville is presented. Last season a number of special attractions were provided on Sundays and holidays, such as balloon ascensions, an elephant on a tight rope and fireworks.

West Side Park is just outside the city limits of Muncie and contains the usual amusement features found in a small park. It has a good theater which has proved to be very popular.

Mound's Park, Anderson, Ind., is a natural park of historic interest, having several large "Indian Mounds" of a peculiar construction which are very unique and interesting. A fine pavilion has been built in this park and a number of popular attractions will be added later.

Steubenville Traction & Light Co.

The Steubenville Traction & Light Co. owns and operates Stanton Park, which is on the interurban division, about three miles from Steubenville, O. The park contains 85 acres and is located in a heavily wooded ravine. A small brook running through the grounds, which is spanned by a number of bridges and has a very pretty waterfall about half way in its course, adds greatly to the attractiveness of the park. The natural beauty of the grounds has been preserved as much as possible. The park contains many springs and an artesian well has been drilled, which gives an abundant supply of water. In the upper part of the park there is a natural amphitheater, in which during the past three years the old soldiers of this region have held their reunions. The park is named for Edwin M. Stanton, the great war secretary, who was a resident of Steubenville.

The park is well supplied with attractions, having a summer theater, roller coaster, merry-go-round, bowling alley, boat swings, refreshment stands, etc. Free band concerts are given every Sunday during the summer, but no other attractions are run on that day. Moving picture and a variety of other exhibitions are provided during the summer season. The theater is located at the entrance to the park and will seat about 700 people. During the past season it was found that light opera and vaudeville were the best paying attractions.

The lighting of this park has been made a feature, many arc lights and incandescents being placed throughout the grounds. No intoxicating liquors are allowed on the grounds and the order preserved is always of the best.

Louisville & Southern Indiana Traction Co.

The Louisville & Southern Indiana Traction Co. owns a very fine public summer resort which is called Glenwood Park. The park is situated on the company's line between New Albany and Jeffersonville, Ind., on the eastern bank of a stream tributary to the Ohio River known as Silver Creek. It is reached from New Albany by a double-track, and from Jeffersonville by a single-track line with frequent turnouts, enabling the company to accommodate a heavy traffic. With the opening of the coming season the connection into Louisville, Ky., will be completed and Louisville patrons will be carried across the Big Four bridge over the Ohio River through Jeffersonville to the park. The park comprises a 12-acre beech grove and a 10-acre athletic field. Nature has made the spot particularly attractive and the hand of man has materially aided in beautifying the scenery.

As is the rule in most of the high-class parks of the country, no intoxicants are sold in or about the grounds. A supply of wholesome water is furnished from two deep wells in the park and also from the New Albany water works. Ample fire protection is afforded, the park being equipped with two fire hydrants, a reel and an adequate supply of hose.

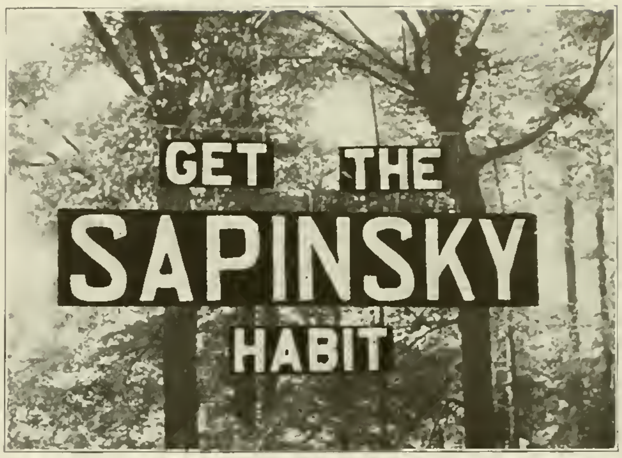
A variety of entertainment is afforded. There is a fully equipped open-air theater with a stage large enough to accommodate quite a pretentious performance and a seating capacity of 1,200. During the past season a number of well known bands were engaged and during the coming season a large orchestra will give concerts in the park every afternoon and evening. A dam has been built across Silver Creek, forming a beautiful lake which has a boating stage a mile long and fine bathing accommodations. Bathhouses will be established and bathing suits rented. A 21-ft. naptha launch and 12, 16-ft. row-boats have been placed on the lake. Other attractions include a miniature railway, box ball and bowling alleys, shooting galleries and a shoot-the-chutes. A dance hall is located under the large beech trees on the bank of Silver Creek and public dances are given every Monday, Wednesday, Friday and Saturday nights. Tuesday and Thursday nights are reserved for private dances.

In connection with the park, although under a separate management, is the Glenwood Athletic Field. The grounds are enclosed by a high board fence and contain a covered grand stand seating several thousand people. The athletic field is open to all associations and teams applying, the rental charged being a percentage of the gate and grand stand receipts.

A unique feature of the park is the electrical advertising signs, one of which is illustrated. A number of these signs are distributed through the park and add substantially to the company's revenue at the same time reducing the cost of lighting the park. The company is in receipt of a number of letters from firms who have used this medium of attracting the public notice, in which they speak highly of the results obtained. The company has leased the park for the coming season to an amusement company which will install a number of amusement devices including a scenic railway, in addition to those already in operation.

A general admission fee of 10 cents is charged at all times except when there is an especially expensive attraction at the park, at which time the charge is advanced.

SHOOT-THE-CHUTES, GLENWOOD PARK, NEW ALBANY, IND.



ADVERTISING SIGN, GLENWOOD PARK, NEW ALBANY, IND.

LOWER LAKE, STANTON PARK, STEUBENVILLE, O.

STANTON PARK THEATER, STEUBENVILLE, O.

BOAT LANDING, BROAD RIPPLE CREEK, INDIANAPOLIS, IND.

Fonda, Johnstown & Gloversville R. R.

Sacandaga Park is beautifully situated in the southern foothills of the Adirondacks. It is the property of the Fonda, Johnston & Gloversville Railroad Co., and is located near the southern terminus of the railway, within half a mile of the village of Northville. The park has a frontage of more than a mile on the Hudson River, the greater part of which consists of a wooded bluff, thickly covered with trees. It is but a six-hour journey from New York City, and is easily accessible from all points in the eastern states. The hunting and fishing in the forests, which lie close at hand, is said to be excellent. The grounds of Sacandaga Park were laid out by skilled landscape artists, while the sanitary arrangements, comprising a complete system of public sewers, and an abundant supply of pure spring water, assure the visitor immunity from malaria and the mosquito pest.

A very handsome hotel, known as the "Adirondack Inn," is located in the grounds and enjoys a wide reputation. It contains a large ball room. Bowling alleys, tennis courts and golf links are found in the grounds. A distinct feature of Sacandaga Park is presented in its advantages as a resort for picnic parties and excursions. Spacious grounds have been provided for the use of transient visitors and outing parties. In the picnic grounds is a rustic theater, where first-class vaudeville performances are given every afternoon and evening during the season. From near the theater a broad pathway leads down to "The Midway," which is located directly on the river. "The Midway" contains a variety of amusement features, including a merry-go-round, zoo, water toboggan and bath houses.

The company has recently purchased a large island lying in the river, near the "Midway," and connected with it by a rustic bridge. The island comprises 60 acres and on it has been laid out a splendid athletic field, containing a grand stand with a seating capacity for 1,500 people.

ST. JOSEPH RAILWAY, LIGHT & POWER CO.

Lake Contrary Park is situated about five miles from St. Joseph, Mo., on the east shore of Lake Contrary, and has all the natural features which go to make an inviting rural retreat. It is reached by a double-track line of the St Joseph Railway, Light & Power Co., has city water and a number of hotels and club houses. It has also good facilities for boating, bathing and fishing.

The season opens May 30th and continues until September 30th, during which time all of the many amusement features are in full swing. A well-equipped theater with a seating capacity of about 2,000 is open every evening, presenting high-class vaudeville. There is also a midway, on which the smaller amusement features are operated, and from time to time free exhibitions of a vaudeville nature are presented out of doors.

An electric fountain is displayed at night and the Casino Concert Band is heard every afternoon and evening. During the summer there are several special events, such as races, encampments and reunions. The management has issued an advertising booklet containing some 35 views of the park, which presents the attractions of the place in a very thorough manner.

Hanover & McSherrystown Street Railway Co.

This park is the property of the Hanover & McSherrystown Street Railway Co. and is under the management of E. M. Grumbine. It is situated on the brow of a hill overlooking the historic village of Hanover, Pa., and commands an uninterrupted view of the valley of the Conewaga. The grounds have been tastefully planned and all improvements which make such a resort attractive have been added. A good restaurant is located on the grounds opposite the terminus of the electric line. An extensive athletic field has been laid out, comprising a baseball diamond, tennis courts, croquet and quoit grounds. An observatory has been placed on the top of the hill overlooking Hanover, from which a view of the surrounding country may be obtained.

The other attractions at the park include a penny arcade or "Electric Vaudeville," shooting galleries, a merry-go-round, cane and knife boards and a billiard and pool parlor. There is also a well-stocked zoo, containing monkeys, deer, wild-cats and a variety of the other inhabitants of the forest and field.

The dancing pavilion is 100 x 32 ft. in size, with a fine maple floor and a good string orchestra in attendance throughout the season. Substantial tables and comfortable seats are scattered throughout the grounds for the benefit of picnickers.

An efficient police force is maintained and the best of order is preserved. No charge for admission is made to the park, and during the summer special attractions are featured, such as vaudeville performances and band concerts.

Cleveland, Painesville & Eastern Railroad Co.

Willoughbeach Park is operated by the Willoughbeach Park Co. of which G. E. Bender, Willoughby, O., is the manager. The park is entering upon its eighth season and has become very popular with the people of Cleveland and adjoining towns. It is located on the shore of Lake Erie, 17 miles from Cleveland and is accessible by way of the shore line division of the Cleveland, Painesville & Eastern R. R. Connections can also be made from the Collinwood and Euclid Beach cars of the Cleveland Electric Ry. at Collinwood, O. The trolley ride to and from the park is particularly delightful, large comfortable cars being provided which make fast time and maintain a frequent service.

The park is operated on a strictly temperance basis, no intoxicating drinks being sold in or about the grounds, thus eliminating the undesirable patronage. Everything has been done which would tend to make the park a desirable place for the picnics of churches and societies.

The park contains modern well-kept buildings and maintains an independent water and sewerage plant which makes the sanitary conditions particularly good. There is a large pavilion with a public kitchen provided for the free use of visitors, also small summer houses, rustic bridges, swings, arbors and a number of lunch tables scattered about in well shaded localities. A fine electric riding gallery is operated in a building having a capacity of about 500 people. There are also a fine beach with good boating and bathing facilities, a large level field for athletic games, and a good baseball diamond.

The structure containing the dance hall is commodious and has a good dining hall in connection. The cafe is in charge of a competent caterer and refreshments are served at all times. The dance hall is open to the public Tuesday, Wednesday and Thursday evenings, and Saturday afternoons. Private parties can secure exclusive use of the hall on Monday or Friday evening. An excellent orchestra is in attendance at all times.

A novel feature is the private depot for the benefit of parties chartering special cars. The chartered cars are run to this building and the patrons thus avoid the crowd found at the regular depot. The park has been thoroughly overhauled during the winter and the coming season will find a number of improvements.

Columbus, Delaware & Marion Railway Co.

The lines of the Columbus, Delaware & Marion Railway Co. reach three parks, known as Glenmary Park, Greenwood Lake Park and Marion Park. Greenwood Lake is owned by a separate corporation and is managed by C. D. Crawford, of Delaware, O. The other two parks are owned and operated by the Columbus, Delaware & Marion Railway Co. under the supervision of the traffic manager, A. L. Neereamer.

Glenmary Park is situated midway between Columbus and Delaware, O., and is less than an hour's ride from either point. It is located on the north side of Slate Hill, which was formerly known as the "Round Stone Hollow," and derived this name from the peculiar round stones deposited there during the glacial period and which were brought to Columbus in considerable numbers to ornament the driveways of many of the old-time houses. The park contains 54 acres, most of which is covered by forest, with ravines and occasional stretches of meadow, which adapt the park to the varied needs of picnics and outing parties. Rustic bridges span the numerous brooks flowing through the park into Trezevant Lake, a picturesque body of water artificially formed by closing the ends of a broad ravine.

CHARTERED CAR DEPOT, WILLOUGHBEACH PARK, WILLOUGHBY, O.

INTERIOR OF THEATER, LAKE CONTRARY PARK, ST. JOSEPH, MO.

RUSTIC THEATER, SACANDAGA PARK.

MINIATURE RACE TRACK, LAKE CONTRARY PARK, ST. JOSEPH, MO.

PAVILION AND DANCING HALL, WILLOUGHBEACH PARK, WILLOUGHBY, O.

A rustic dancing pavilion is located among the trees with 6,000 sq. ft. of floor space. Stationary swings have been set up for the children and there are also tennis courts, golf links and a baseball diamond.

Greenwood Lake Park is a wild and rugged pleasure resort of 50 acres, containing a beautiful lake extending over half a mile following the windings of a deep ravine and covering an area of 20 acres. The lake is fed by natural springs and dotted with wooded islands. Excellent fishing is found in these waters and in the shallow pools at the head of the lake is a magnificent bed of African lotus. The other attractions include boating, bowling, dancing, tennis, an open-air theater and other outdoor amusements. There is also a well-equipped restaurant which can cater to the requirements of a large number.

Marion Park is located nine miles south of Marion and comprises 30 acres of wood and meadow land stretching along the banks of the Scioto River. The river at this point is broad and affords ample opportunity for boating. A large dancing pavilion and auditorium is placed in the grove and there are also merry-go-rounds, shooting galleries and other attractions.

The lines of the Columbus, Delaware & Marion Railway Co. also reach Olentangy Park, which is described elsewhere in this issue.

Philadelphia Rapid Transit Co.

Willow Grove Park is owned by the Philadelphia Rapid Transit Co. It is situated in Montgomery county, 13 miles from the center of Philadelphia, and is the terminus of six direct car lines, making it easy of access from all points in and about the city. It covers an area of more than 100 acres, containing many natural and artificial beauties. The most popular feature of the park is the superior order of the musical attractions. Only the best known bands and orchestras in the country are engaged, and the class of patronage thus attracted is of a high grade. Last season the musical attractions included Sousa's Band, Victor Herbert's Orchestra, Conway's Ithaca Band, Wheelock's United States Indian Band, and Damrosch's Orchestra. This park was described at considerable length in the "Street Railway Review" for September, 1905, and we are pleased to refer our readers to page 549 of that issue for more complete information.

Easton Transit Co.

Island Park is situated about four miles from the city of Easton, Pa., on an island in the Lehigh River. It is operated by the Easton Amusement Co., of which D. E. Se Guine is the manager, and is owned by the Easton Transit Co. The park contains a good theater, which was erected during the past season. It is 37 x 75 ft. in size, with three dressing rooms on either side of a stage large enough to accommodate the average performance. There are 815 reserved seats and 1,200 free seats. Only one class of entertainment, namely vaudeville, has been tried at the theater. This has given every satisfaction, and it is expected that this same form of amusement will be continued during the coming season.

Other attractions consist of a Ferris wheel, a dancing pavilion, 70 x 117 ft. in size with a 14-ft. promenade around the entire building, a gasoline launch, row-boats, a carrousel, a miniature railway and a penny arcade. There is a small midway, along which are located various other attractions. A restaurant and a band stand are also included in the equipment.

The Easton Transit Co. has issued a folder which contains time tables and a complete map of the line and some advertising matter in regard to the park. The rates of fare from nearby towns in Pennsylvania are also presented.

Joliet, Plainfield & Aurora R. R.

Electric Park is located at Plainfield, Ill., on the Du Page River, 10 miles from Joliet and 12 miles from Aurora. The park is operated by the Joliet, Plainfield & Aurora Railroad Co. under the management of H. A. Fischer, who is also vice-president and general manager of the road.

The management is erecting for the coming season a theater building with a seating capacity of 3,000 people. The auditorium is to be circular in shape, with a sloping earth floor and an ornamental front 120 ft. wide and two stories high. This front is to contain restaurant booths on the first floor and a dining room up stairs. The stage will be 40 x 30 ft. with ample dressing rooms and a full equipment for handling ordinary vaudeville shows. The object of this building is to not only provide a theater, but also an assembly hall for conventions and a Chautauqua. The Will County Chautauqua will be held in this park during the coming summer.

Among the other attractions on the grounds are the bowling alley, a dancing platform 80 x 140 ft., a merry-go-round, an equipment of 36 steel row-boats and a gasoline launch, bath houses and a toboggan slide for the bathers, a baseball park provided with a commodious grand stand and a miniature railway operated by gasoline motor cars pulling trailers.

This company has recently purchased a tract of six acres immediately adjoining the park, which has been laid out in a sub-division for camping purposes, and on these grounds will be erected 50 canvas cottages. These cottages are provided with permanent floors and roofs and are boarded up on the sides for about three feet; the canvas is then used for the balance of the sides and all openings and doors are screened. These grounds will be piped for city water and gas for cooking purposes, illuminated with electric lights and completely sewered throughout. Additional grounds are provided for parties desiring to use canvas tents in place of cottages. A large water tank and an observation tower will be built and a number of small electric fountains will be supplied from this tank.

During the past season the management made a specialty of securing military encampments, and for a time the park was the camping ground of the Columbus Rifles. It has been found that the best drawing card for the park has been the band and orchestra concerts provided, and this feature will be enlarged upon the coming season. The management is also considering the installation of a pipe organ in the auditorium.

Mobile Light & Railroad Co.

The Mobile Light & Railroad Co., Mobile, Ala., owns and operates a park on Mobile Bay, known as Monroe Park. This park contains 40 acres of land, which includes a ball park as well as the other park attractions. Monroe Park is situated three miles from the center of the city and on the edge of the built-up residence district. It is reached by three lines of cars in the summer, only one of which run to the park in the winter.

The particular attraction at Monroe Park is the gulf breeze. The prevailing breeze of the summer time is from the gulf and crowds congregate at Monroe Park to breathe the cool air as it comes in. The improvements at the park consist of a casino, where refreshments are sold, a skating rink, bowling alley, laughing gallery, carrousel and a theater.

In the theater the most popular form of amusement is the summer opera. This draws greater crowds than any other amusement which is given inside the theater and for which an admission fee is charged. Every night during the summer moving pictures are shown in the open air and have proven a good drawing card. At times during the season out-door attractions are engaged, but at this park it is not necessary to go to any great expense to draw the crowds, as the park of itself is so attractive that people go there whether there are any special entertainments on or not, but the amusement devices are not neglected.

The park has been self-sustaining; that is, the amounts received from the concessions sold have paid for all the expense of operation. Band concerts are given each Sunday afternoon and night. The park is used largely by benevolent associations for the giving of picnics. On these nights an admission fee of ten cents is charged to the park; on other nights the admission is free. These associations give very large picnics, have fireworks, free outside shows and in one way and another give attractions that draw large crowds to the park.

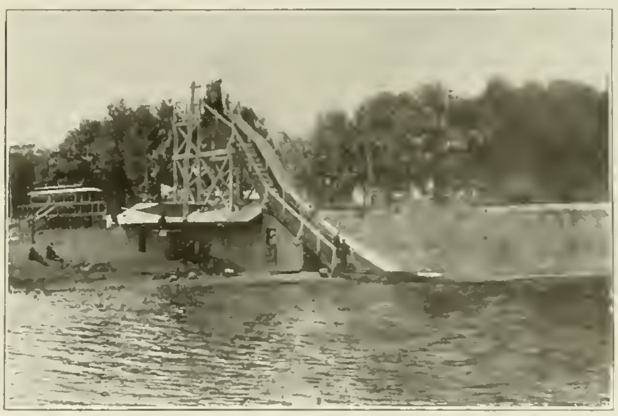
The season at Monroe Park begins about April 20th and lasts until the middle of October. It is visited through the entire year, but there are no shows of any kind given except between April and October. J. H. Wilson is president and manager of the Mobile Light & Railroad Co.

DANCING PAVILION, ISLAND PARK, EASTON, PA.

CASINO, MONROE PARK, MOBILE, ALA.

VIEW OF LAKES IN WILLOW GROVE PARK, WILLOW GROVE, PA.

THE CASINO, ISLAND PARK, EASTON, PA.



THE CHUTES, ELECTRIC PARK, PLAINFIELD, ILL.

International Railway Co. of Buffalo.

Olcott Beach Park is owned and operated by the International Railway Co. of Buffalo, N. Y. It is situated amid very pleasing surroundings, and is reached by trolley from four large cities, being 37 miles from Buffalo, 37 miles from Niagara Falls, 27 miles from Tonawanda and 13 miles from Lockport. The majority of the patronage is from Lockport, which is the shorter haul. A large and well-planned terminal station, which has been designed for the rapid handling of the crowds, is placed at the park entrance. The route from the city of Buffalo to the park lies through the fruit section of Niagara County, passing many peach and apple orchards. At points where the city lines intersect the road to the park transfer from these lines to the through cars is made, credit for the transfer being allowed by the conductor of the Olcott cars when tickets are purchased.

The park has a rustic theater, which has a capacity of about 800. It is leased by theatrical interests, vaudeville being presented and a ten cent admission charge being made. The management finds that this form of entertainment is the most popular, and it will be continued.

A large hotel known as the Olcott Beach Hotel is situated within the park. It has 70 rooms and a cafe, which will seat 700 persons. There is also a large casino for indoor theatricals and dancing.

A number of other attractions are operated, including an electric riding gallery, a miniature railway and several smaller features.

The Union Electric Co., of Dubuque, Ia.

The Union Electric Co. has four parks, all located on what is called, the "main line," this being a long double track division running north and south, paralleling the Mississippi River.

The first of these is Athletic Park, the home of the Dubuque Club of the Three-I Baseball League, and the scene of football contests and other outdoor sports. The company is the largest stockholder, and in fact the owner, of the baseball club. The club is now entering on its fourth season, and up to date it has been necessary for the street railway company to contribute liberally each year in order to maintain the team. It has been found that the induced traffic on account of the baseball situation warranted the expenditure and left a small margin of profit. Dubuque is an enthusiastic ball town, the report of the secretary and treasurer showing that the team took in nearly $17,000 last year.

The next park on the line is Schuetzen Park, which is owned by the corporation, but leased to an individual. It embraces some 50 or 60 acres, has a fine grove, a large dance hall, bowling alleys, a restaurant, a few animals and other small features.

Last year the lessee of the park and the street railway company erected an outdoor theater, the stage, scenery and all settings being permanent. Seating accommodations for 1,200 people were afforded by benches under the trees, the enclosure being effected by a ten-foot canvas wall. The park completely equipped was turned over to the local vaudeville manager, who put on the shows and conducted the theater as an individual venture. There was an admission charge of 10 cents, with an additional charge of 10 cents for reserved seats. High grade vaudeville was put on, the cost of the shows, with advertising, stage expenses, etc., running from $500 to $650 per week. The theater is in fine shape and no doubt will be utilized for the same purpose another year. The theater was known as the "Bijou White City," and was under the management of Jacob Rosenthal.

A mile further north is Nutwood Park, the home of the Tri-State Fair. This is a tract of 75 acres, embracing a fine mile track, grand stands, exhibition halls, stables, and a complete equipment for the conduct of fairs and cattle shows.

This property is owned by the street railway company and its use donated to the Tri-State Fair Association. Two most successful fairs have been conducted and the annual show is scheduled for September of this year. Agricultural machinery, live stock, poultry, farm products and the usual class of exhibits found at state fairs are provided, with a fine racing program, outdoor attractions and a line of meritorious paid shows.

The park in which the company takes the greatest interest is Union Park. This is located a mile and half north of Nutwood Park and cars in reaching it run through a rugged, rocky gorge.

There have not been extensive improvements made at this point, for nature made such a lavish provision that the company determined that the erection of the usual park features would cheapen and rob the spot of its greatest charm. There are 100 acres in this tract, with unlimited range on all sides, there being no restriction by the abutting property holders. The most beautiful wild flowers bloom in profusion and at places there are perpendicular reaches of rock with fine forest trees on all sides.

At present the equipment consists of a dwelling occupied by the park keeper, a dance hall, bowling alley, pavilion, refreshment stand, band stand, and a large equipment of tables and benches which are used by picnic parties.

During the past season the company put on a few high grade attractions, such as band concerts, which met with marked success. The plan for the coming season is to reconstruct the present buildings, making them larger and more modern, with a rustic band stand among the trees, ample provision being made in the new structure to conduct the outdoor entertainments under cover in the event of inclement weather.

The company maintains an ample force at the park to keep up the numerous flower designs and maintain a general system of order. No intoxicating liquors are allowed on the grounds.

A feature of this park is an underground tunnel or cave. Entrance is effected by a flight of stairs some 60 ft. in height, the ceiling of the cave being in places 50 ft. in height. It is possible to travel a distance of a mile and half in this underground passage. The cave is brilliantly lighted by electricity, and the temperature in summer, as a rule, is 50 degrees lower than that outside.

Oregon Water Power & Railway Co.

The Oregon Water Power & Railway Co. owns an amusement park which is called The Oaks. It is located on the Willamette River, about three miles from the center of the city of Portland, Ore. The park is situated on a point of land projecting into the river and is surrounded on three sides by water. A board walk 1,250 ft. long has been erected along one side of the park with suitable boat landings. The railway company operates park trains of two or three cars which make the run from the city to the park in 15 minutes. The park is also reached by boats of all classes.

No theater is operated. A large and well-equipped restaurant has been built out over the river on piling, and a good dancing pavilion is also included. The amusement features consist of a circle swing, shoot the chutes, the bumps and other devices usual to amusement parks.

The Oaks was operated last season by the railway company, but it is expected to lease the park for the coming summer to an amusement company which is being formed for that purpose. A new water power plant is being established on the Clackamas River which will have a capacity of 20,000 h. p. and, in the future, the company will develop its own power and lease all concessions to the auxiliary company.

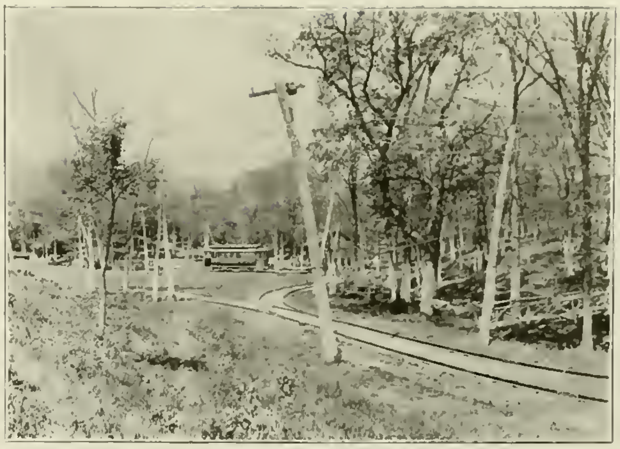
The park is the home of the Oregon Yacht Club, which has its club house and docks at one end of the park, and is the scene of the club's annual regattas.

The Seattle Electric Co.

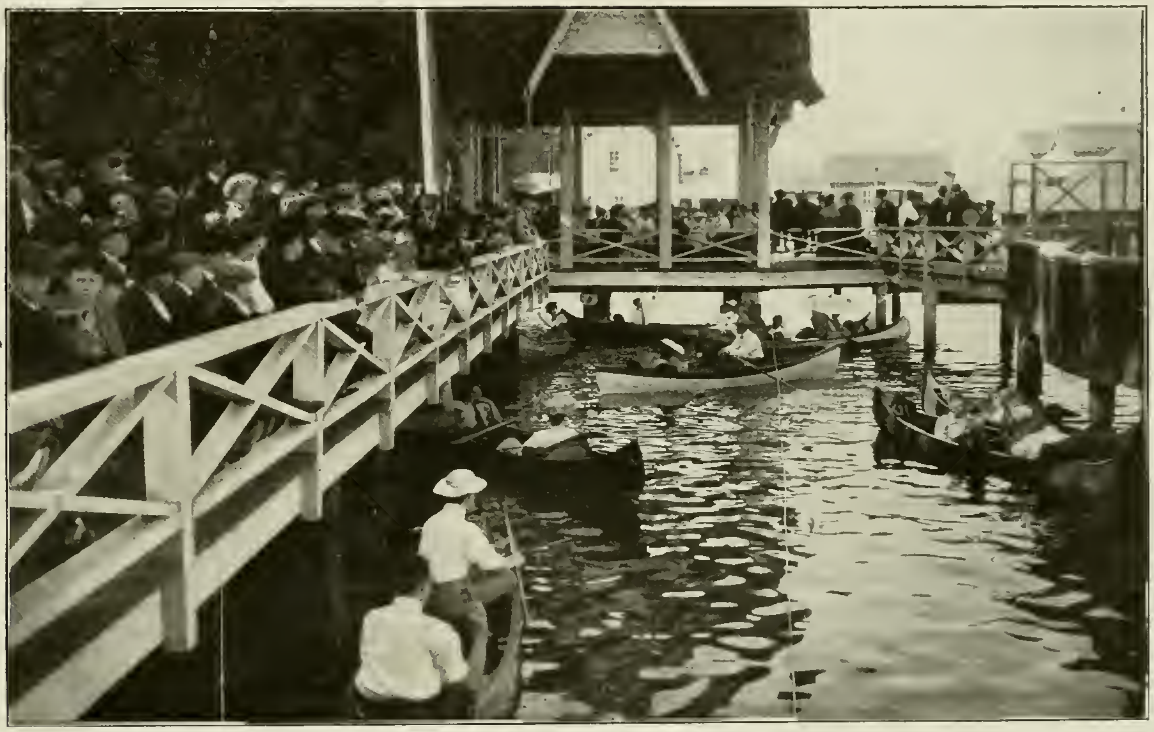
The Seattle Electric Co. owns and operates three parks situated on the west shore of Lake Washington, about three miles from the center of the city of Seattle. These parks are excellent examples of the results that can be obtained when nature is intelligently aided by artificial means. Two of them, Madison and Leschi Parks, are reached by cable roads, while the third, Madrona Park, is served by an electric line. Practically the same attractions are found at the three parks Certain refreshment and dance hall privileges are leased to outside parties, but their control is held by the company The special features include band concerts, dancing, canoeing and the other smaller attractions which are usually found in any summer amusement resort.

Several years ago theaters were operated at two of the parks, presenting vaudeville performances of more or less merit, but in both cases, after repeated trials, the venture proved a financial failure and was therefore abandoned. The parks are also reached by steamboat lines, which have fine docking facilities at the parks.

RUSTIC THEATER, OLCOTT BEACH PARK, LAKE ONTARIO, N. Y.



UNION PARK, DUBUQUE, IA.



A SUNDAY CROWD AT MADISON PARK, SEATTLE, WASH.

GENERAL VIEW OF MADISON PARK FROM LAKE WASHINGTON, SEATTLE, WASH.

Elmira Water, Light & Railroad Co.

Rorick's Glen Park is operated by the Rorick's Glen Park Association, of which Henry Taylor is the manager, and is served by the lines of the Elmira Water, Light & Railroad Co. It is located on the banks of the Chemung River about a mile from the city of Elmira, N. Y. The principal attraction at the park is a theater with a seating capacity of 2,000 and a full equipment of scenery. Light opera, given by a stock company, with a change of bill each week, has been found to be the best paying form of attraction in this locality.

The grounds are tastefully laid out and contain some beautiful flower beds, which are lighted at night with colored electric lamps placed among the flowers. The grounds, theater and flying machine, which is another of the popular attractions of this resort, are covered with lights, affording a brilliant display after dark. The management operates row-boats on the river, which are largely patronized. The park is a very popular resort for picnic parties from Elmira and the surrounding country.

Columbus Railway & Light Co.

Olentangy Park is served by the lines of the Columbus Railway & Light Co. It is situated at the northern limits of the city of Columbus, O., and four miles from the center of the city. The entire park, with all the amusements, is owned and operated by The Olentangy Park Co., organized in 1899, with a capital stock of $100,000, although much more than that amount is now invested in the park. J. W. Dusenbury is president and general manager of the company, and Will J. Dusenbury is secretary and treasurer, and these two personally manage the park and control the company.

The park contains about 100 acres of beautifully wooded grounds, intersected by deep ravines. The Olentangy River flows through the park, affording excellent boating and bathing facilities. The main portion of the grounds is situated on a comparatively level plateau, which descends abruptly through a distance of about 60 ft. to the edge of the river. This plateau is divided into four main parts by three deep ravines which are crossed by bridges. There are four of these bridges within the park, the largest of which is 380 ft. long, 24 ft. wide, and 60 ft. above the bottom of the ravine. The buildings and amusement devices, with the exception of the boat house and docks, bowling alleys, and the bathing pavilion, are all located on the plateau.

Among the different amusements to be found in the park are "Ye Olde Mill," a three-way figure-eight toboggan, Ferris wheel, mechanical shooting gallery, pony and camel track, and a palace of illusions. In addition to the foregoing there are ball racks, knife boards, cane racks, Japanese rolling ball games, a dart gallery and other small games. There are also a good restaurant, a palm garden, in which soft drinks and ice cream are served, and a Japanese village.

The main building in the park is the theater, which is 250 ft. long and 150 ft. wide. It contains a balcony and gallery, the total seating capacity being 2,680. The floor is saucer-shaped, having a pitch toward the stage from all directions. The seats, interior decorations and stage equipment are equal to those of most city theaters, and the stage will accommodate the average production. The prices at the theater are 10, 20 and 30 cents, and the box seats, 50 cents. All kinds of entertainments are given in the theater, but it has been found that good vaudeville is the most remunerative, and attention is now confined to that class of entertainment, with occasional weeks of musical concerts, such as Creatore's Band, Liberati's Band, Innes's Band, The Kilties Band, etc. Performances are given every afternoon and evening, including Sunday, each performance lasting about two and a half hours. There is an entire change of bill each week.

A Zoological Garden occupies about 20 acres at the southern end of the park, and is said to be surpassed only by the zoological gardens of the large cities. Steam-heated buildings are provided for the animals, accustomed to a warm climate. The animals include all the species of carnivora, such as lions, tigers, leopards, pumas, jaguars, ocelots, hyenas and a number of bears, wolves, foxes and raccoons. There are also sea lions, alligators, birds of many kinds, monkeys, camels, ponies, elk, buffalo, nylghau, and a variety of deer. The zoo is free to all park visitors.

The Museum of Ornithology occupies a building, 30 x 70 ft. in floor area, which is filled with specimens of birds of every kind native to the region. This is said to be the largest and best collection of the kind in the state. This is also free to park patrons.

There is also a large green house, arranged for a display of tropical plants in summer, and in winter is used for propagating and caring for the flowers and plants used in beautifying the grounds. It is found that this not only affords a beautiful and interesting display of flowers and plants in the summer, but enables the management to have more flowers on the grounds and at less expense than would otherwise be entailed.

The Japanese Village contains about ten acres and is complete in every respect, some of the structures and many of the exhibits being brought from the St. Louis Exposition. The plants and shrubs used were imported from Japan and the landscape gardening and the construction and decoration of all the buildings were done by Japanese workmen. It has been found that the Japanese Village, or "Fair Japan," as it is called, appeals particularly to the better class of people. There were over fifty Japanese in the village last season.

The main line of the Columbus Railway & Light Co. enters the southern end of the park on a loop and unloads and loads its passengers at a commodious station within the park. Cars are run on this line at all times with intervals of five minutes and when the business requires, the cars follow one another with scarcely any headway. The attendance averages about 8,000 on ordinary days, and from 25,000 to 30,000 on Sundays, holidays and special days. The Columbus, Delaware & Marion Ry. runs past the park and unloads passengers at the park entrance. Passengers from all the other interurban lines entering the city as well as from the steam roads can reach the park over these two main lines.

No intoxicating liquors are sold or permitted on the park grounds. All the amusements are said to be remunerative. With the exception of the theater the figure-eight toboggan and "Ye Olde Mill," are considered the most profitable. The Japanese Village has also proven quite successful.

Free open-air attractions such as looping-the-loop, leaping-the-gap, dog and pony circuses, etc., are frequently introduced. A band which gives open-air concerts every afternoon and evening is a permanent feature of the park.

The company also operates Minerva Park, which is owned by the Columbus Railway & Light Co., and is located ten miles from the city of Columbus.

Austin Electric Railway Co.

Hyde Park is situated a short distance from the city of Austin, Tex., and is served by the line of the Austin Electric Railway Co. The natural beauties of the park have been added to by artificial means and a small stream spanned by a number of rustic bridges flows through the grounds, making it a very attractive place for a day's recreation. About five acres are included and many shade trees are scattered about.

The chief attraction at the park is a summer theater, which has a large stage, six dressing rooms, a complete equipment of scenery and a seating capacity of 1,200. Small opera troupes and stock companies are engaged and these forms of entertainment are very popular.

The Ithaca Street Railway Co.

Renwick Beach Park is situated at the southern end of Cayuga Lake, the largest of the beautiful chain of lakes that adds so much to the picturesqueness of western and central New York. The lake is 38 miles long and has a width of four miles in the widest part. It is celebrated for the purity and clearness of its water in summer and its ice in winter. It is off Renwick Beach that Coach Courtney, of Cornell University, trains his victorious crews from year to year. The park and beach are two miles from the city of Ithaca, N. Y., and are served by the Ithaca Street Ry., the park owner and operator, by the Ithaca & Cayuga Heights Electric Ry., and by several lines of lake steamers. The grounds are very attractive and contain a theater, band stand, bathing houses, steamboat pier and an observation tower, from which there is a beautiful view

THEATER AT OLENTANGY PARK, COLUMBUS, O.

BOAT LANDING, RENWICK BEACH PARK, ITHACA, N. Y.

down the lake. Ithaca is the home of the popular and widely known Ithaca Band, which gives concerts at the park on week day evenings and Sunday afternoons and evenings. The park theater has a stage 20 x 36 ft. in size and a seating capacity of over 700. Musical comedies and vaudeville are the principal entertainments.

The most notable characteristic of Renwick Beach Park is the good order which is preserved there. It is policed by veterans from the city police force and no intoxicants are sold. Every other kind of commodity needed is sold in the various buildings by reputable people, who lease the concessions from the company. Edward G. Wyckoff, of Ithaca, is president and principal owner of the Ithaca Street Railway Co., and Renwick Beach Park, and Robert L. Post, general manager of the company and the park.

Bay City Traction & Electric Co.

The Bay City Traction & Electric Co., Bay City, Mich., owns and operates Wenona Beach Park. The park is situated on Saginaw Bay, an arm of Lake Huron, about two miles from the Saginaw River and about five miles from Bay City. The company maintains a 25-minute schedule between the city and the Beach and the ride makes a very pleasant preface to a day's outing at the park. The park proper covers about 27 acres and is lighted with 3,000 incandescent lamps arranged to good advantage. Considerable time and thought have been expended in the arrangement of the grounds and the general result obtained is very pleasing.

A large summer theater, known as the Casino, forms one of the principal attractions. The stage has a proscenium opening of 50 ft., a width of 120 ft. from wall to wall, a depth of 35 ft. from the curtain line and a height of 65 ft. from the floor to the gridiron. At present, the management is playing nothing but vaudeville. Five acts are given each week and the performance is closed with the exhibition of a moving-picture machine, the bill being changed weekly. An orchestra of eight pieces and a complete scenic equipment is maintained and the management has found that the theater is an excellent money-getter. The casino has a seating capacity of 2,500 people and compares favorably with the majority of the vaudeville theaters found in the smaller cities.

Every facility for bathing and boating has been provided. At this point on Saginaw Bay, the beach is exceptionally fine and is crowded daily. Among the other amusements are included a roller coaster, shooting galleries, a penny arcade, a circle swing and an old mill. These attractions are largely patronized and have been found very profitable. A restaurant is also operated and a first-class service is maintained. The dining-room overlooks the bay and the diner may enjoy the view and listen to the restaurant orchestra while eating his meal. The management issues a very attractive illustrated booklet descriptive of the park which includes a schedule of the rate of fare from various points to the park. Special inducements in the nature of reduced rates are offered to excursion parties. L. W. Richards is the park manager.

Anniston Electric & Gas Co.

The Anniston Electric & Gas Co. has operated Oxford Lake Park since 1889, and in fact, at that time changed the corporate name of the street railway to the "Oxford Lake Line." It was continued as such until 1899 when that company was consolidated with the Anniston Electric & Street Railway Co. and the Anniston Gas & Light Co., under the corporate name of the Anniston Electric & Gas Co. The street railway at Anniston, Ala., was originally started in 1884 as a horse car line, operated between the town of Oxford, three miles below Anniston, and Anniston, which even at that time, was a larger place than the old town of Oxford, one of the earliest settled towns in the state. The fare to Oxford is ten cents and Oxford Lake is one mile beyond.

OBSERVATION TOWER AND CAFE, RENWICK BEACH PARK, ITHACA, N. Y.

As there is no other body of water near Anniston the lake furnishes the only opportunity for those who like boating to enjoy that sport. There are 24 row-boats on the lake, in addition to a launch. The lake is fed by two bowl springs, having a flow of a million and a half gallons daily, and an electrically driven pump distributes spring water to all parts of the grounds, to be used for both drinking and irrigating purposes. The lake has been stocked with fine black bass, generally incorrectly called trout and to prevent continuous fishing by people who would soon reduce the stock, a charge of five cents a pound for fish actually caught is made and parties known to sell the fish are prohibited from using the privilege.

Other revenue producing amusements are an electric merry-go-round and a swimming pool, with the pool so arranged that it can be divided into two sections so that ladies and children alone can use a part, separate and distinct from the men and boys, or the whole can be thrown together. This swimming pool has been one of the best paying features. When the original pool was rebuilt a few years ago, using concrete throughout instead of wood, a portion of the pool was made very shallow and a wire netting stretched across, so that the smallest children could go in with safety. The

OXFORD LAKE PARK—ANNISTON, ALA.

company itself operates all of the amusement features and rents out only the refreshment stands.

Last summer completed the sixth successful season of vaudeville at the summer theater in the park. While this is so open at the sides as to be cool and pleasant, it is thoroughly protected from the weather and has enabled the management to give performances every weekday night without missing a single performance. In the operation of the vaudeville, moving pictures have been made a feature and illustrated songs are frequently presented.

For several years the park had two regular sized bowling alleys, but last year the building was burned and two box-ball alleys were installed in another building. It is intended to replace the bowling alleys and house them, together with the box-ball outfit, in another building.

Two large dancing pavilions are provided, the use of which is given to private parties gratuitously. The lighting of these buildings is included, but compensation is derived from special cars, for which an increased price is charged if held out beyond the regular schedule.

None of the smaller amusement devices are included in the park, for the management considers that they would soon become an old story to the limited population it caters to. Although the park consists of 70 acres and has numerous buildings which must be kept in

WHERE THE FUN BEGINS AT WENONA BEACH PARK, BAY CITY, MICH.

repair, it has been self-supporting for a number of years. All of the increased business secured on the line through the ownership and operation of the park has been at no cost for park maintenance.

Heretofore negroes have been permitted to go to Oxford Lake Park and a gallery has been provided for them at the theater. But in the South the combination of white and colored patronage does not work at all well and the company has decided to build an extension to its line through Hobson City, to a site for a park to be used exclusively by negroes, and known as Hobson City Park. A large pavilion will be built on these grounds at once, to be used for dancing purposes, roller skating and amusements of different kinds. The baseball ground will be laid out and free swings, tables, etc., provided. This park will be controlled by a stock company capitalized at a nominal amount, the stockholders in which are prominent people in Anniston, whose intention is to in turn sell this stock to the negroes themselves, that they may acquire the ownership of the stock paying for it on the installment plan.

FIGURE-EIGHT TOBOGGAN, VINEWOOD PARK, TOPEKA, KAN.

Topeka Railway Co.

The Topeka Railway Co. owns an amusement resort which is known as Vinewood Park and is located at the terminus of the company's Vinewood Division, six miles from the city of Topeka, Kan. Approximately 275 acres of woodland are included in the park, through which winds a picturesque stream spanned by a number of rustic bridges. Two concrete regulating dams have been built which control the water supply. The natural beauty of the place is of a high order, but 40 acres have been further improved and the park compares favorably with anything of its kind in the country.

ARTIFICIAL LAGOON, VINEWOOD PARK, TOPEKA, KAN.

Illustrations are herewith presented of the large figure-eight toboggan, which was installed by the Philadelphia Toboggan Co., and of the band stand, which is in the shape of a large sound shell, situated within an enclosure seating 1,500 people. The park also includes a summer theater seating 800 people, a dance hall and a well-equipped cafe. For the coming season the owner is contemplating further improvements consisting of a carrousel and a number of smaller amusement devices.

Shamokin & Edgewood Electric Railway Co.

Edgewood Park is picturesquely located among the mountains of Pennsylvania. It is controlled by the Shamokin & Edgewood Electric Railway Co., and is but a short run over the company's line from Shamokin. The park contains 80 acres of mountain forest land including shaded walks, rustic summer houses and well-planned flower beds. It is a graceful combination of nature's handiwork and the landscape gardener's art.

A very attractive feature of the park is Edgewood Lake, a sheet of water covering several acres, near the center of which is a little flower-covered island. Another interesting feature is the deer park, where a large number of these animals are kept. An excellent cafe is maintained, which supplies meals and luncheons at all times. There is also a fine dancing pavilion, and throughout the season

BAND CONCERT, AT VINEWOOD PARK, TOPEKA, KAN.

an orchestra furnishes music during the afternoons and evenings.

Abundant provision is made for picnic parties who desire to prepare their own meals. There is an unlimited supply of pure water, ice and fuel are furnished free, and a number of rustic tables and benches are located under the trees about the grounds. A good baseball field with commodious grand stand accommodations has been provided. The electric cars connect with all trains on the Pennsylvania and Philadelphia & Reading railroads and run direct to the park.

Saginaw Valley Traction Co.

The Saginaw Valley Traction Co. owns and operates Riverside Park, which is situated on the historic Titibawassee River. This region was once the home of many Indian tribes and contains historical spots which their sojourn here has rendered interesting. The park is situated within the city limits and is about four miles from the center of the city. The natural beauty of the river bank has left little of an artificial nature to be done. The entrance to the park is particularly pleasing. From a distance it appears to have been cut out of a solid mass of green and the car passes through a lane of foliage whose branches are interlaced in an artistic manner.

A well-equipped theater is operated in connection with the park, where high grade vaudeville shows are presented. Attractions other than vaudeville have been tried, but it has been found that the best results were obtained from this form of amusement. The theater has a seating capacity of 1,500, a stage with 2,700 sq. ft. of floor space, well-equipped dressing rooms, a complete equipment of scenery and good lighting facilities. The general admission to the theater is 10 cents, the reserved seats being sold at 15 cents.

Among the other concessions is a good restaurant and refreshment parlor. A variety of amusement devices are operated, including a roller coaster, a circle swing, a roller-skating rink, 110 x 175 ft., bowling alleys, a laughing gallery, Japanese box ball and shooting galleries. A small zoo is also maintained.

A private canoe club has its club house located at the park. It has a membership of about 150, and from time to time during the season gives regattas in which the general public takes a great deal of interest. The Saginaw Valley Traction Co. maintains a 40-minute schedule to the park on week days and 30 minutes on Sundays. The company distributes some interesting advertising matter

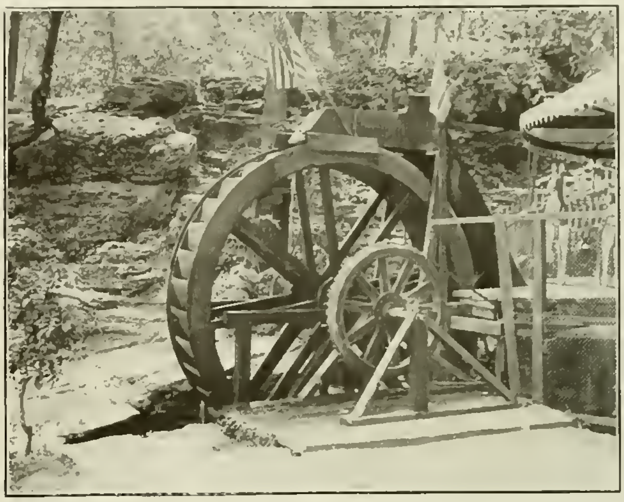
AMUSEMENTS AT HYDE PARK, MUSKOGEE, I. T.

relative to the park, which includes the rates of fare. L. W. Richards is the park manager.

Muskogee Electric Traction Co.

Hyde Park, which is leased and managed by A. A. Kinney, is located on the banks of the Arkansas River, five miles from Muskogee, I. T., a growing city of 30,000 population. The park is reached over the line of the Muskogee Electric Traction Co., which furnishes an excellent park service. The ride to the park is one of the principal features in connection with a day's outing there. The route is laid over the prairies and through the forests of this picturesque country and is very attractive.

The park contains a well-equipped theater with a large stage and a seating capacity of 1,500. During the season the management presents a variety of entertainment at the theater, including a comic opera, melodrama and musical comedy, which have proved excellent drawing cards. Facilities for bathing in the Arkansas River are provided, and among the other attractions are a skating rink,



RUSTIC WATERWHEEL, DOLING PARK, SPRINGFIELD, MO.

dancing pavilion, billiard and pool hall and a merry-go-round. Excursion boats are operated on the Arkansas River and run between the park and a number of points along the river. A good baseball diamond is provided and a feature is a ball team of Creek Indians which plays frequently at the park. The Hyde Park Band gives daily concerts and there are numerous other attractions. The management reports a bright outlook for the coming season.

Springfield Traction Co.

Doling Park is operated by an independent park company of which R. L. Doling is the manager. The Springfield Traction Co. furnishes transportation to the park from all parts of the city of Springfield, Mo., and the railway company and the park management work together to their mutual profit. The daily average attendance throughout the season is about 800 except on special days when it runs well into the thousands.

Doling Park comprises 44 acres and is a natural park of some pretentions. The grounds are carefully policed, all intoxicating drinks and gambling devices are forbidden and a high order of respectability is maintained. The park attractions include a fine theater with a seating capacity of 2,500 and a well equipped stage. During the season a stock company presents two good plays each week, interspersed with special vaudeville features. There is also a natural cave extending 1,000 ft. into the earth, through which runs a stream on which visitors are carried by boats to a waterfall. A novel idea in the operation of park attractions is found in the fact that this stream operates a merry-go-round by means of the rustic water wheel shown in the accompanying illustration.

New cars for limited service on the Indiana Union Traction Co's. lines are being constructed in the company's shops at Anderson and it is thought that they will be ready for use in the near future. The cars will be elegantly finished and will be furnished with revolving wicker chairs.

The Montreal Street Railway Co.'s officials have of late been sent several remittances of conscience money. Three letters have been received recently, one containing 70 cents and another $2. A letter was also received from J. W. Cunningham, a clergyman, containing $20, which Mr. Cunningham says was handed to him to forward to the company by a man whose conscience was troubling him, because he had "done" the company out of this amount.

THE
STREET RAILWAY
REVIEW
AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE
KENFIELD PUBLISHING CO.,
45-47 PLYMOUTH PLACE, CHICAGO, ILL.
Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:
New York—39 Cortlandt Street. Cleveland—302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:
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Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

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This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XVI FEBRUARY 15, 1906 No. 2

CONTENTS OF THIS NUMBER.

PREPARATIONS FOR HANDLING PARK TRAFFIC.

It is none too early at this time to map out plans for handling traffic during the coming park season, for each year's experience teaches the progressive manager what to do toward improving the pleasure business of the next season. The expeditious handling of large crowds of people without confusion or discomfort is one of the most difficult of transportation problems. Few systems have been developed to a point where the enormous peak loads which follow the closing of a large park in the evening are handled with entire satisfaction to everybody, and perhaps it is too much to expect that the desire of several thousand people to go home simultaneously can be gratified without excessive crowding on the cars at certain points near the park exits. Nevertheless, as far as these conditions can be overcome, the resulting satisfaction given to the company's patrons is the best form of advertising.

A. S. & I. R. A. MEMBERSHIP.

The executive committee of the American Street & Interurban Railway Association has just held a very satisfactory meeting at its new permanent office, No. 60 Wall St., New York City. A large number of the association officers was present, including President Ely and Secretary Swenson. At this meeting the secretary presented a report of the work that has been done since the annual meeting in Philadelphia. Much has already been accomplished and suitable plans have been laid for a successful year's work in the strengthening and upbuilding of the reorganized body.

The membership committee reported that since the fall meeting there have been sent out to non-member companies two carefully prepared circular letters calling attention to the plans for the future work of the reorganized association and urging non-member companies to signify their approval of the broad co-operative scheme of the reorganization and amalgamation of the several associations by becoming members. These letters, which were signed by H. H. Vreeland, chairman of the membership committee, have been answered by 49 companies, which as a result have joined the association. The letters have also been the means of initiating a large amount of correspondence between Mr. Swenson, the association secretary, and the non-member companies. It is to be hoped that this correspondence will greatly swell the membership roll.

There are many reasons why each and every street or interurban railway in North America should be a member of the American Street & Interurban Railway Association, a few of which it may be well to emphasize:

Active work has already been done on the subject of municipal ownership. The association will keep in touch with the municipal ownership investigating committee of the National Civic Federation. It is stated that the work of this committee will be most comprehensive in its scope, and will be of importance to the electric railway interests of the country. Insurance matters are now being considered and the association is co-operating with the fire underwriters on the revision of the National Electric Code. Such questions as franchise rights, taxes, etc., will also be given much attention by the association. Investigations of technical problems will be taken up at an early date, so that the association will soon be in a position to send out information of value along various technical lines, all of which reports should be of great interest and value to any railway property, large or small.

PARK TRAFFIC.

In the past, the trackage facilities at the park entrances and exits have often been too limited to give the best results. It is impossible to properly handle the peak load at a park unless the local conditions are improved to the fullest practicable extent. We must remember that the peak load at a street railway park differs from the rush hour traffic of a large city in that the former case practically all the passengers appear upon the scene ready to be carried away within a few moments, while in the latter case the abnormal load is distributed over a much longer period, say an hour or an hour and a half. Hence the methods employed in the one case cannot be expected to fit the other conditions.

One of the fortunate aspects of the problem of handling park traffic is found in the time at which the peak load occurs. On any system which operates many extra cars in the afternoon rush hour there is very little reason why plenty of rolling stock cannot be available at ten or ten-thirty in the evening or when-

ever the park closes. Sometimes a sharp peak occurs at a park just before dinner in the afternoon, and if this peak coincides with the regular afternoon rush from the business district to the residential section, it is simply out of the question to handle the park traffic as skilfully as it can be done in the evening. However, the great majority of afternoon patrons at street railway parks are women and children, and a more moderate movement of the rolling stock is permissible than as though the facilities were demanded by men.

The installation of loop tracks at the entrances and exits is in general preferable to the use of stub tracks and crossovers at these points. Small parks can be well taken care of usually by a single loop, but large parks require both loop and stub tracks for the best results. At large parks stub tracks are essential for the storage of cars and the loops for the rapid, steady movement of traffic as soon as the performance is over.

As a rule, it is a comparatively simple matter to carry passengers to a park, for the arrivals are better distributed than the departures. The separation of entrances and exits is desirable in all large park layouts, for it is a great advantage to avoid bringing two opposing crowds together at the loading and unloading platforms. This point is well illustrated by the excellent arrangements at Norumbego Park, near Boston, and the combination of loops and stubs at the Minnesota State Fair Grounds in St. Paul presents a good example of a layout capable of handling from 15,000 to 20,000 people per hour without confusion. Every park which accommodates hundreds or even thousands of patrons should be provided with a spur track upon which any disabled car can be run, for the blocking of the main line traffic at such times is a serious trouble. First class telephone facilities should also be available between the park and the various car houses and shops of the system.

POWER SUPPLY FOR PARK LINES.

The question of power supply for lines leading to parks is important. On an alternating current-direct current system perhaps the simplest way out of the difficulties which occur is to install a portable sub-station near the point where the heaviest loads occur, using the equipment elsewhere in the winter season. The use of series boosters at the power house is not an economical method of handling distant peak loads, generally, but in some cases the traffic gained thereby is so large that the additional cost of power is of little importance. Sometimes a floating storage battery can be installed at the park to advantage and especially so if it can be used elsewhere on the system in the winter season. The same reasoning applies, of course, to the purchase of transformers and rotaries for park service. Heavy feeder investments are to be shunned for any but all-the-year-round operation. Given an alternating system throughout, with single-phase motors under the cars, the problem of supplying power for peak loads at parks grows less formidable, for the reason that the cost of stationary transformer sub-stations is far below that demanded by an alternating-current rotary-converter system. Sometimes on a simple direct-current system special tie lines can be cut in between the park routes and other tracks to the lasting benefit of the former. By raising the generator voltage at the power station during the park rush traffic the situation can be relieved somewhat, provided the machines will stand the strain. If the compounding does not hold up well, separate excitation may be tried, with good prospects of success during the half hour when things are at their worst. In extreme cases additional copper can be strung for the summer work and sold when the season ends. It is all a question of what the park earnings will justify, but hap-hazard decisions are to be avoided.

MINOR CONVENIENCES AT PARKS.

Money expended in developing and advertising a street railway park is generally parcelled out in a good many different directions, but the fundamental idea is to make the place attractive to all classes of people. Sometimes the natural beauties of the locality enable the park to be created without any large expense for landscape gardening; in other cases the entire premises needs skillful treatment in order to draw patronage. In either event, there is no doubt of the wisdom of putting some of the capital invested into minor conveniences for the comfort of the public.

The larger the park, the more important it is to maintain good order, to provide ample toilet facilities, and to foresee emergencies. The wooden structures used in many parks are bad fire risks, and the installation of chemical extinguishers, sand and water pails should always be thoroughly carried out. No park should be without a public telephone station and in cases where thousands of people congregate some sort of a retiring room or lodge with several cots and an emergency medicine set should be at hand. When boats, canoes and swimming sports are enjoyed, there should be an attendant within immediate call in case of accident. The life saving service at many ocean cities is a pointed illustration of the importance of organized anticipation of emergencies. Mailing facilities are also desirable in the large parks.

These things cost money, but they add so much to the popularity of a resort that their profitableness in the long run is undoubted. The rental of books and sale of stationery are not out of place in some parks. Concessions of this kind are usually eagerly sought after, and the question is often what to eliminate rather than what to encourage. Cleanliness, good lighting, free, pure water, good quality in food sold on the grounds and a general atmosphere of comfort are worth much to any park, and yet these properties are often lacking. Thoroughness of detail counts with the patronizing public.

MANAGER DALRYMPLE'S REPORT ON THE CHICAGO TRACTION SITUATION.

Ever since Manager Dalrymple of Glasgow visited Chicago for the purpose of examining into and reporting upon the street railway conditions of the city, and this being at the request of the municipal ownership advocates, the general public has shown an especial desire to learn the sense of the Scotchman's report. A report was formulated and sent Mayor Dunne, but the ideas of the visitor have been so jealously guarded that even the Chicago City Council was not advised as to whether Mr. Dalrymple reported favorably or against an immediate municipal ownership. The Chicago mayor maintained that Mr. Dalrymple came as a personal guest at the mayor's expense and not at the request of the city. The aldermen questioned this idea and passed a motion requesting that the report be made public. On the refusal of the mayor to do this, Manager Dalrymple was advised of the wishes of the Chicago council and has made some interesting statements in the Chicago Tribune. In discussing the Chicago traction situation the foreign manager says:

"Ever since my visit to Chicago I have closely followed the Chicago tramways problem, and can only confirm the opinion expressed in my first report submitted to Mayor Dunne that the condition of the plant of the Chicago railways today, owing mainly to the disputes going on between the different companies and the city, is in wretched condition. Of course, there has been no inducement to spend money on bettering the system owing to the uncertain position of the companies with reference to the continuance of private operation.

"As to the municipalization of the Chicago tramways, I have in my letter to Mayor Dunne given my ideas as to the best and quickest way of bringing this about under present circumstances. Undoubtedly there are difficulties in the way of doing this, one of these being the long franchise owned by the companies.

"I have been following the course of events closely and have considered carefully all proposals made by the companies to the city with reference to the terms of purchase. In my opinion the suggestions made by the companies are fair and reasonable.

"Of course, I am not saying whether the municipality should extend the franchises or not, but if they were not in a mind to extend the franchises the proposal of the companies that the city should acquire the entire systems is fair on a basis of the municipality gradually getting charge of the different lines and systems at stated times. This would surmount the difficulties of the long franchises owned by the companies. Therefore, I can see no reason why the city should not acquire the roads if it really wants them.

"To take over the railways would cost a vast sum of money, but the greatest cost would come in putting the lines and the plant in repair. I understand that $75,000,000 is proposed for this purpose. Well, that sum would just be a starter. The roads are in such condition that enormous sums would have to be spent on them to bring them up to what I call efficiency.

"I might mention that our entire Glasgow system cost only $15,000,000, but, of course, the Chicago street railway system is ten times larger than that of Glasgow.

"As to the question of municipalization itself I can only say that it works well here in Glasgow, but that is because we operate the lines just the same as if we were a private company. We are not in the least influenced by questions of politics. Our main concern is to run the lines and make them beneficial to our citizens and efficiently operated, just the same as they would be by a well organized private company, with all the advantages of private management, irrespective of public control, political influence, or jobbery.

"Glasgow today has the best paying street railway system in the world. Everything in connection with our tramways, both in regard to revenue and expenditure, is done as in operation by a private company. Whatever surplus we make goes toward the improvement of the plant and car service, extension of the lines, and increased facilities. We put on two cars in place of one wherever we consider it will better the service, and our equipment and plant are kept up to the highest order of efficiency.

"Our cost of operation is not any cheaper per car mile than the cost in Chicago, for, though our wages are lower, our operatives do not work such long hours and our cars are not run so fast as in Chicago. If you don't run your cars so fast you don't get as much work done. Neither is our revenue per mile much different from the American tramway lines, but our fares to the man on the street are cheaper. We have a one-cent fare, and fares are graded according to distance up to 10 cents. The revenue works out about the same as the American five-cent fare with transfers, but we think the one-cent fare, ranging up to four cents, suits the largest body of the community.

"One great difference is that our cars carry almost twice as many people as those of the Chicago system. Therefore we can give twice as many people seats. We have seats on top of all our cars, each car carrying 24 inside and 36 on top. We carry twice as many people per car mile as Chicago, and all our people get seating accommodation. One-third of our population pays only a one-cent fare, and our average fare is considerably less than two cents."

Mr. Dalyrymple's statement, as the newspaper states, goes far to explain why Mayor Dunne has so carefully suppressed his report as to the difficulties in the way of Chicago going into the street car business.

The $75,000,000 which Mayor Dunne wants to borrow by the sale of Mueller law certificates to purchase the existing street car properties with, Mr. Dalrymple says, "would only be a starter" in the necessary expenditures for this purpose, and Chicago would have to go a great deal deeper into its pocket if it is going to make the investment.

This statement is directly opposed to the position taken by the mayor and his municipal ownership friends throughout the entire discussion, they holding that while $75,000,000 is the sum named in the ordinance to be submitted to the people next spring, in fact not nearly that amount of money would be needed, and the only reason $75,000,000 was named was because some sum had to be fixed, and that was as good as any other. It makes it decidedly awkward to have Mr. Dalrymple say that $75,000,000 would be "only a starter."

Mr. Dalrymple, it will be noted, also says that the cost of operation in Glasgow, per car mile, is as great as in Chicago, in spite of the fact that the wages paid in Glasgow are less. This also contradicts the argument of Mayor Dunne and his advisers, who have been claiming that the cost of operation under municipal ownership, even when the rate of wages is the same, will be less than that of privately owned companies.

To have Mr. Dalrymple say that with lower wages in Glasgow the cost of operation is as high as it is in Chicago and ascribe it to the fact the municipal employes do not do as good work may be disconcerting to the Chicago advocates of municipal ownership.

The Cleveland & Southwestern Traction Co. has improved its service between Cleveland and Wooster, and will also put on a limited service between Cleveland and Oberlin. The limited car service will cover the distance in one and one half hours. It will give a service to Elyria in one hour and five minutes.

Some New and Novel Operating Schemes.

In order to increase and maintain the efficiency and to improve the service of the electric railroad system and also to endeavor in every possible way to satisfy the patrons of its lines, the new management of the Chippewa Valley Electric Railroad Co. has introduced a few innovations in the service. One is the "complaint blank." General Manager George B. Wheeler has printed blanks on which patrons can write complaints or suggestions, the blanks, when filled, to be left at or mailed to the main office of the company. The purpose of this is to ascertain through the public whether any of the employes of the company are remiss in their duty or what improvements and changes in the present service would prove beneficial and popular with the patrons of the road. All employes of the company will have some of these blanks which can be procured on application.

The "no fare" envelope is another idea which will be introduced shortly. This will be adopted for the convenience of patrons who find themselves without money when the conductor comes around for the fares. At the present time, in such a contingency, the fare has come out of the conductors' own pocket, and, owing to the fact of the conductors being changed from one part of the line to another, a person owing the conductor frequently fails to find him till the incident is forgotten, and the latter does not like to ask for it, and so he is money out. Hereafter in such cases patrons will be handed a "no-fare" envelope into which they can later place the fares which they were short, and this they can hand to the next conductor, who will ring the fares up and give them credit therefor. A record of these envelopes will be kept at the office.

Central Electric Railway Association Plans.

At a meeting of the officers and directors of the newly-formed Central Electric Railway Association, held at the Claypool Hotel, Indianapolis, Ind., on February 7th, the following plans were definitely determined upon.

The association will open headquarters in the Traction Terminal Building in Indianapolis, the first of March. John H. Merrill, of Lima, O., has been appointed permanent secretary of the association, and will be in charge of the offices. A bureau of interchangeable mileage will be established in connection with the association headquarters.

Secretary Merrill is well known in traction circles, having had many years experience in the railway field. He has been connected with the Western Ohio Traction Co. as auditor and for two years has been chairman of the transportation committee of the Ohio Interurban Railway Association. Mr. Merrill is practically the father of the interurban interchangeable mileage book of which there are now over 1,200 in use. These books are accepted on 35 Ohio, Indiana and Michigan traction lines.

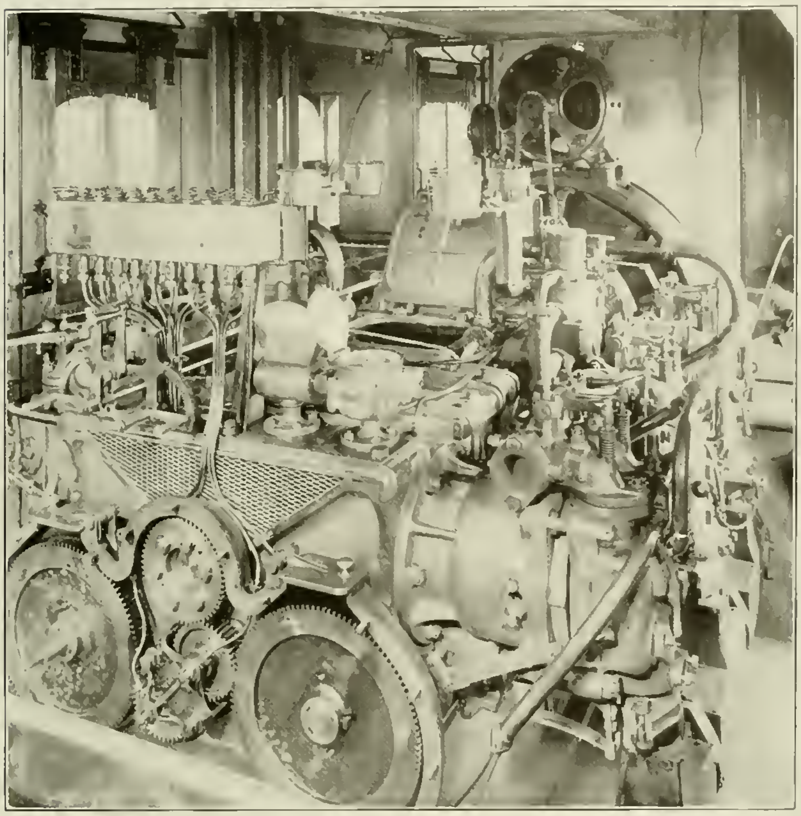
The cities of Columbus, Cleveland and Dayton were considered for the association headquarters, but Indianapolis was selected, the officers thinking it the most central point in view of the fact that many of the roads of Illinois and Kentucky have signified their intention of joining the Central Electric Railway Association.

Among those present at the meeting were President E. C. Spring, general superintendent Dayton, Covington & Piqua Traction Co., Dayton, O.; vice presidents, Charles L. Henry, president and general manager, Indianapolis & Cincinnati Traction Co., Indianapolis, Ind., and F. D. Carpenter, general mangaer Western Ohio Railway Co., Lima, O.,, and the following members of the executive board: H. A. Nicholl, general manager Indiana Union Traction Co., Anderson, Ind.; W. G. Irwin, general manager Indianapolis, Columbus & Southern Traction Co., Columbus, Ind.; C. C. Reynolds, general manager of the Indiana properties of the Dolan-Morgan-McGowan Syndicate, Lafayette, Ind.; G. F. Wells, manager Terre Haute Traction & Light Co., Terre Haute, Ind.; H. P. Clegg, general manager Dayton & Troy Electric Railway Co., Dayton, O.; C. N. Wilcoxon, general superintendent Cleveland & Southwestern Traction Co., Cleveland, O.; F. J. J. Sloat, general manager Cincinnati, Dayton & Toledo Traction Co., Hamilton, O.; and J. W. Brown, superintendent of transportation, West Penn Railways Co., Connellsville, Pa.

The next meeting of the Central Electric Railway Association will be held in Indianapolis, on March 22d.

An Interesting Gasoline-Electric Car.

In sparsely settled districts, where the cost of operating a steam drawn train is prohibitive and the immediate investment of capital for an electric service unwarranted, there has arisen a need for a self-contained car which shall be independent of a feeder system and at the same time be cheaper to operate than the ordinary locomotive and train. For this purpose, the General Electric Co., in conjunction with the American Locomotive Works, at Schenectady, N. Y., has recently completed a gasoline-electric car which presents many features of interest.



ENGINE ROOM OF THE DELAWARE & HUDSON GASOLINE-ELECTRIC CAR.

NEW GASOLINE-ELECTRIC CAR OF THE DELAWARE & HUDSON CO.

The first trial run of this novel car took place February 3rd, when a successful trip was made from Schenectady to Saratoga, N. Y., and return, over the lines of the Delaware & Hudson R. R. While the car was not designed for high speed, the average running time was about 35 m. p. h., and several times the car attained a speed of 40 m. p. h. The smooth and rapid acceleration was favorably commented upon by the engineers present.

The equipment consists essentially of a gasoline-driven electric generator furnishing current to electric motors geared to the driving wheels and controlled by a method similar to that employed in the ordinary electric car equipment. The car shown in the illustration is divided into passenger, smoking, baggage, engine, toilet and motorman's compartments. The car is 65 ft. long over all and equipped weighs 65 tons. A complete controlling equipment is located at each end of the car, one controller in the engine room and a similar controller in a compartment at the other end. The car has a seating capacity of 40 passengers, including seats for 12 in the smoking room. In general it is built on the lines of a standard Delaware & Hudson R. R. passenger coach, and is handsomely finished. The Gould pattern bumpers and drawbars are provided.

The gasoline engine for this car was built by the Wolseley Tool & Motor Car Co., Ltd., Birmingham, Eng., and is considered one of the most powerful units yet constructed for this class of work; it develops 160 brake h. p. at a speed of 450 r. p. m. The cylinders are horizontal opposed, six in number, with 9-in. diameter and 10-in. stroke. All valves are mechanically operated, and the cylinders are water-cooled. Hitherto, difficulty has been experienced in starting internal combustion engines of this size, but in the present case this difficulty has been overcome by using shells filled with black powder to provide the initial charge in one cylinder. On starting the engine, the shell is fired by a hand trigger, the whole being similar to the breech mechanism of a gun. Jump spark and low tension ignition are both provided, current being furnished to the latter by a small magneto driven from the engine shaft.

The volatilization of the liquid fuel is produced in two carburetors which form an integral part of the engine. Each carburetor supplies three cylinders and is equipped with two float-feed chambers. The chambers are identical and are of the usual needle-valve type. Very flexible arrangements are provided to govern the air supply so that it may be taken from the atmosphere or from the crank chamber, or from both, according to the temperature required. The mixture is heated to the required temperature in a small chamber which itself is warmed by the exhaust. In all details the engine is very complete. The lubrication for the main bearings and pistons is force-feed and drip-feed for all other working parts. Gasoline is stored in steel tanks beneath the car, and the burnt gases pass through the

roof into mufflers, from which they exhaust into the air. The cooling system for the cylinders consists of radiating tubes located on the top of the car. Water for cooling is contained in the engine base. For heating the car, a three-way cock is provided which by-passes the circulating water through the usual pipe heating system.

The main current is furnished by a 120-kw. direct-connected General Electric six-pole generator, designed for 600 volts pressure. This generator is provided with commutating poles, which in connection with the method of voltage control, permits a very flexible operating system. The advantage of commutating poles is evident when it is considered that the field excitation at starting is weak, and the large current at low voltage is required to give the necessary torque. Owing to the peculiar operating conditions of this system, the generator while retaining the characteristics of a shunt-wound machine, is separately excited by a 5½-kw., two-pole compound-wound exciter, working at 110 volts. This is located on top of the generator and is driven by a Morse silent chain.

There are two No. 69 motors of standard railway construction, which need no special description.

For regulating the speed of the motors, as mentioned, voltage control is used; in other words, the speed of the car is governed by varying the field strength of the generator. With this method the speed of the engine remains constant after acceleration. The controller is semi-automatic, and can be set for any predetermined maximum acceleration. It is arranged for series-parallel control, the motor connections being changed from series to parallel by the reversing handle. This handle has five position; series ahead, parallel ahead, off, series reverse and parallel reverse. Arrangements are provided to prevent the motor connections from being changed from series to parallel until the resistance is put in the field circuit of the generator.

The trial trip demonstrated the practicability of this car equipment, and was entirely satisfactory to the engineers so far as the tests indicated. The opinion was expressed that this was merely a step toward the final electrification of all service. A gasoline car would be useful in establishing a passenger traffic, but eventually the motive power for operation would be electricity.

The accompanying photograph of the car was taken after the arrival in Saratoga. The group standing in front of the car includes many prominent officials of the two companies interested.

The Eleventh Annual Report of the Boston Transit Commission.

The Boston Transit Commission has recently issued its eleventh annual report, which contains an interesting report of the last year's progress.

The Washington St. Tunnel, now in process of building, is a two-track structure for the passage of trains and cars north and south through the congested portion of the city connecting with the elevated structure at either end. During the year work has been carried on in five sections of this tunnel and as a result traffic on Washington St. has been interfered with somewhat, but the provisions of the act which require public streets and places to be left open for traffic between 8 a. m. and 6 p. m. on each secular day have been adhered to and it is believed that the work has been prosecuted without unreasonable inconvenience to the public. Considering the volume of traffic on the sidewalks and streets in connection with the width of those sidewalks and streets it was determined in all cases to make the entrances in private property and so far as possible, on side streets. As stated in the last annual report, when the commission selected for the tunnel from its southern end to Haymarket Square, the route east of Washington St., the Boston Elevated Railway Co. appealed from its decision to the Board of Railroad Commissioners and that board fixed upon Washington St. as the best route but thought it advisable to stop at the junction of Washington St. and Adams Sq. To secure good alignment and grades for the tunnel from State St. north, without interfering seriously with the traffic capacity of the present subway, is a very difficult problem. Thus far, no plan has been adopted.

At the date of the last report it is stated that work on the connection of the East Boston tunnel with the subway had been suspended because of the request of the Boston Elevated Railway Co. for a curve of larger radius than it had formerly approved, in order to permit the passage of longer and wider cars than those now in use by the company, and because of the fact that compliance with this request would be impossible unless more funds were appropriated by the legislature.

For this reason a communication was addressed to the legislature of 1905 which passed an act restoring to the commission the balance of the $316,000 for which it asked. Owing to a controversy between the commission and the Boston Elevated Railway Co. with regard to the installation of ventilating apparatus the commission has installed the apparatus in order that there might be no delay in the opening and operation of the tunnel. After that portion of the tunnel which is under the harbor had been completed according to the original plans, it was found that the leakage while inconsiderable in amount, spread over the interior wall and in such a way as to give an impression of dampness, and was not pleasing to the eye. This portion of the tunnel was therefore lined with ribbed tile of fireproof clay, covered with cement, so that the face of the wall is now smooth and comparatively dry. The total leakage in the tunnel is about seven gallons per minute which is much less than in any other tunnel yet constructed under similar conditions. On Dec. 20, 1904, the tunnel was officially inspected by the Governor of the State, a representative of the Mayor of Boston, heads of State and City departments and other invited guests. On the next day the tunnel was opened for public traffic. Reports for the first three months of use indicate that the gross income to the city from the tolls will be at least $80,000 per annum. The total cost of the subway is $4,124,686, while the cost charged to the Boston Elevated Railway Co. as a basis for rental is $4,100,482, giving a difference of $24,204. Of this amount, $23,670 is accounted for in the fifth annual report. The balance, $533, while carried on the books of the commission and the city auditor as part of the cost of the subway, has been expended for purposes which are not chargeable to the company in determining the cost upon which rental is based.

The report of the chief engineer shows that work on the Washington St. tunnel has been in progress during the past season from near State St. on the north to the southern limit, not far from Oak St. Of the whole length of the tunnel, 50 per cent will be straight, 33 per cent will have a curvature of about 500-ft. radius, 2 per cent of about 1,800-ft. radius and 15 per cent of about 500-ft. radius. Forty per cent of the tunnel will be level, the remainder varying from a one to five per cent grade. On account of the narrowness and irregularity of the street and the frequency of station platforms, the cross section of the tunnel is very irregular and is rarely uniform for more than a few feet in length. Most of the sewer, water and gas pipes and other structures under the street require to be moved to a new position and many service pipes are to be laid cross-wise to connect with the different buildings. For these reasons, most of the earth from the pavement down to the bottom of the tunnel is necessarily taken out. The work has been carried on in such a way as to interfere but little with the traffic of the street. The paved surface of the street has been replaced little by little with heavy planking laid flush with the original surface of the paving and supported on timbers, and most of the work in the daytime has been done under this bridging. The work has been done generally in the following manner: Underpining is done where necessary; side walls are built in narrow trenches, one at a time; new sewers are built in or near them; interior posts, if any, are placed in a narrow trench; the roof is put on; the core is dug out; and finally the invert is completed.

Statistical tables are included in the report regarding the work on Washington St., and additional information is given which could not readily be tabulated. This is, for the most part, compiled from the reports of the assistant engineers. The report also includes a number of drawings and photographs which illustrate the progress of the work. The officers of the Boston Transit Commission are as follows: George G. Crocker, chairman; B. Leighton Beal, secretary, and Howard A. Carson, chief engineer. The commissioners are, Chas. H. Dalton, Thos. J. Gargan, Geo. F. Swain and Horace G. Allen. The officers of the commission are at 15 Beacon St., Boston, Mass.

The car barns of the International Railway Co. were destroyed by fire February 12th. A snowplow and 27 cars were burned.

Personal.

MR. E. A. BURRELL has recently been made manager of the Peoria & Pekin Terminal Ry., to succeed Mr. G. W. Talbott, who has gone to California.

MR. F. T. POMEROY was re-elected president of the Cleveland & Southwestern Traction Co. at a recent meeting of the board of directors. Mr. J. T. Wilson was elected treasurer, to succeed Mr. F. L. Fuller, who retires.

JUDGE CARLOS M. STONE, of Cleveland, Ohio, has recently been elected president of the Toledo & Western Railway Co. to succeed Judge Luther Allen, deceased. The other officers of the company were all re-elected.

MR. C. C. COLLINS, who has been general freight agent for the Appleyard lines, has resigned, and will take a similar position with a western traction company. Mr. Collins has been with the Appleyard lines for several years.

MR. W. A. GIBBS has tendered his resignation as general manager of the Zanesville Railway, Light & Power Co., and has accepted a responsible position with the H. M. Byllesby Co., Chicago, the former owners of the above company.

MR. R. W. DAY, formerly claim agent for the Wilkes-Barre & Wyoming Valley Traction Co., has been appointed general manager of the Northern Electric Street Railway Co., which company is about to build a line from Scranton to Factoryville.

MR. R. W. HARRIS has tendered his resignation as superintendent of the Michigan Traction Co., and will leave Kalamazoo. Mr. Harris thoroughly understands the electric street railway and traction business and has made a large number of friends in Kalamazoo.

MR. JOHN I. BEGGS, president of the Milwaukee Electric Railway & Light Co., has been re-elected a director of the Laclede Gas Light Co., of St. Louis, Mo. At a later meeting of the new board of directors Mr. Beggs was unanimously re-elected president of the company.

MR. FRANK W. ROOD, who since the incorporation and construction of the Columbus, Delaware & Marion Electric Railway Co. has served as auditor of that company, has resigned. Mr. Rood will go to New York City, where he will enter the employ of a large eastern corporation.

MR. JAMES R. PRATT has been elected to the newly created office of assistant general manager of the United Railways of Baltimore. Mr. Pratt has been in the employ of the company since 1891, and for several years prior to his promotion has been head of the claim department.

MR. G. H. BOWERS has severed his relations as secretary and treasurer of the Peckham Manufacturing Co., of Kingston, N. Y. Mr. Bowers, who has an exceptionally wide circle of friends in the electric railway field, will have a part in the responsible undertakings of the Audit Co., of New York City.

MR. R. E. HUNT has resigned his position as manager and purchasing agent of the Augusta Railway & Electric Co., Augusta, Ga. Mr. Hunt will go to Norfolk, Va., where he will take up some special work for E. C. Hathaway, vice-president and general manager of the Norfolk Railway & Lighting Co.

MR. J. R. HARRIGAN, who for four years has been at the head of the Newark interurban lines; general manager of the Columbus, Newark & Zanesville, the Columbus, Buckeye Lake & Newark, and the Newark & Granville roads, has announced his resignation. Mr. Harrigan has accepted the management of the Canton & Akron road.

MR. IRA A. McCORMICK, who was general manager of the Cleveland Electric Ry. from 1900 to 1902, has been made general superintendent of the electrical division of the New York Central & Hudson River R. R. Mr. McCormick has had a varied experience as a railroad man and his promotion is regarded with much pleasure in railway circles.

MR. REGINALD B. HAMILTON, who held the position of chief clerk to Mr. T. E. Mitten with the International Railway Co. at Buffalo, New York, and later with the Chicago City Railway Co., has recently been appointed purchasing agent of the Chicago City Railway Co., to succeed Mr. G. T. Bergen, who has resigned after having filled that position for 11 years.

MR. C. C. REYNOLDS has been elected general manager of all the merger property in Indiana of the Dolan-Morgan-McGowan syndicate. Mr. Charles Murdock was elected first vice-president of all the companies. Mr. Reynolds and Mr. Murdock will assist Mr. McGowan in the active management and operation of the interurban lines and will relieve him of the details of work.

MR. M. G. LINN, who has been assistant general manager and purchasing agent for the Illinois Traction Co., has been transferred to Bloomington, Ill., to take up his duties as superintendent of all the Bloomington interests of the Illinois Traction Co., and the direction of the construction of the Bloomington-Peoria interurban line. Mr. W. J. Ferris has been chosen as successor to Mr. Linn.

MR. E. W. MOORE was elected president of the Lake Shore Electric Ry. at a recent meeting of the board of directors at Cleveland, O. Mr. Moore succeeds Mr. W. S. Bicknell who resigned the position of president January 1st. The road is now in splendid condition and it is predicted that it will have considerable prosperity under the presidency of Mr. Moore. Mr. Moore will give his undivided attention to the property.

MR. JAMES A. MILNE, who has for a number of years been comptroller of the Allis-Chalmers Co., has accepted the position of general manager of the Allis-Chalmers-Bullock, Ltd., Montreal, Canada, to become effective on or before May 1, 1906. Mr. Milne is a native of Canada, having been born at Watertown, Ont., in 1872. When he had completed a public school and collegiate course, he began his business career at Toronto in 1888. After a general business experience he entered the employ of the Allis-Chalmers Co. as chief cost clerk and soon was appointed acting comptroller, being formally elected to that position in May, 1902. Since last autumn, Mr. Milne has been one of the directors of Allis-Chalmers-Bullock, Ltd., and the fact that he still retains Canadian citizenship, and is deeply attached to his early associations, has been an important factor in influencing him to heed a recall to the Dominion.

JAMES A. MILNE.

MR. J. E. FEIGHT has been appointed general manager of the Dayton & Northern Traction Co., to succeed Ralph E. De Weese, who resigned on account of ill health. During the past year Mr. Feight has been superintendent of the Dayton & Muncie road and in recognition of his efficient services he has been chosen to look after both lines. The two companies will not consolidate but will simply be controlled by the one manager, with headquarters in Dayton.

MR. E. H. VALENTINE, president of the Valentine-Clark Company, Chicago, has disposed of his interests in that company to Mr. E. L. Clark, formerly secretary and treasurer, and who now succeeds Mr. Valentine as president, the corporate name of the company continuing as heretofore. Mr. Clark has been identified with the company since its formation, and enjoys an extensive acquaintance with producers and consumers of poles for power transmission construction work.

MR. ROBERT MATHIAS, who has been connected with the Frank Ridlon Co. and the Chas. N. Wood Electric Co. for the last five years, has accepted a position in the street railway department of the Stuart-Howland Co., of Boston, Mass. Mr. Mathias has held the positions of station electrician with the New York Edison Co. and chief electrician for the Baldwin Locomotive Works, of Philadelphia, Pa., but more recently has devoted his attention to street railway work. He is well-known in the electric field and should prove a valuable acquisition to the selling force of the Stuart-Howland Co.

The Toronto Railway Co. has re-organized its claim department. All the work formerly done by detective bureaus at high rates will be done by the company. The trial of the new method has given every satisfaction.

The United Railway Co. of St. Louis, is making extensive additions to its system which include five 1,000-kw. and three 500-kw. rotary converters and a bank of six-phase air blast transformers for this group of converters.

Summer Parks.

BY JOS. D. GLASS, MANAGER, LAKE MINNEQUA PARK, PUEBLO, COLO.

Today summer amusement enterprises in the United States have practically resolved themselves into suburban resorts owned, or controlled, and operated by street railway and transportation lines.

In the early history of these ventures the individual who possessed landed holdings near a city of sufficient size to boast of a "horse-car" or "tramway" would provide "picnic" grounds, and, eventually, add improvements by subsidy from the street-railway company.

The germ of this idea has grown until every well conducted urban or suburban line has its own park, or else has under contemplation such an adjunct for capturing the small change of the community during the heated term.

As a rule, and with hardly a single exception, transportation companies do not go into the park business for the profit to be derived from the amusement end, but are actuated alone by the desire to increase the haul. While occasionally one road may be found that reaps a profit from the new departure ten can be easily had who will readily testify to a loss, and for this condition there is a well grounded reason.

A community large enough to maintain a street car system is amply large to make profitable a summer resort, but to make it profitable from a transportation standpoint it must not exceed in cost that sum on which the local bank rate of interest will be greater than the net returns from the investment.

The natural or artificial beauty of a park is not, as a general thing, alone sufficient to attract paying crowds, and the elements which read success in one resort do not correspondingly spell the same in another city of equal size but of a people of different temperament.

Some communities are more responsive than others, and often expensive features fail to arouse the enthusiasm which makes essential the strengthening of the "hold-on" straps.

Inexpensive amusements are the best attractions and it is an established fact that a 10-cent gate admission promotes rather than hinders in securing the best behaved and the most liberal spenders.

A few, a very few, amusement devices are desirable in the smallest park, but frequently large mistakes are made in the installation of expensive ones, the cost of daily maintenance being a tax of considerable amount. Occasionally ambitious park builders and promoters may be held responsible for ill-returns and dissatisfaction on the part of investors.

Overlook Park.

The Dayton, Covington & Piqua Traction Co. owns and operates Overlook Park. The park is situated on a bluff overlooking the Stillwater River at West Milton, O. The company owns 80 acres of land at this point, which includes some picturesque scenery. The park is maintained exclusively as a picnic resort. The only attractions provided are a dancing pavilion, 80 x 100 ft. in size, a dining pavilion and a boat landing, with 30 boats including a naptha launch.

The park is located midway between Dayton and Piqua, 16 miles from either city. It has been self-supporting by the lease of privileges and has proved a source of considerable revenue to the company. It contains the Rifle Range of the Third Regiment of the Ohio National Guard and is also its camping ground for one week each summer. The club house of the Dayton Bicycle Club is located in one corner of the park and many private dances are given during the summer.

A high standard of order is maintained at the park, no liquor being allowed upon the grounds. A mile and a half of boating over one of the prettiest stretches of the Stillwater River forms one of the most attractive features of the park. The management has gone to considerable expense to add to the natural beauty of the park and the Glen with its waterfall, winding staircase and rustic bridge is a pleasing addition. The view from the park down the valley of the Stillwater has been much admired. This beautiful valley, varying from one to three miles in width, is dotted here and there by prosperous looking farms with now and then a village half buried among the trees.

The park is under the personal supervision and management of Edward C. Spring, general superintendent of the Dayton, Covington & Piqua Traction Co., who has demonstrated that a resort of this nature can be operated without any expense to the company and still add materially to the receipts of the road.

Olympia Park.

Olympia Park is owned by the Chattanooga Electric Railway Co., being located about two miles from Chattanooga, Tenn., and is easy of access to people from the entire city and suburbs. The park, which comprises 50 acres, is reached by three different car lines and is operated by the street railway company, of which James A. Dakin is the manager.

A theater seating 1,200 does a most flourishing business throughout the season, which begins May 1st and ends September 1st. The form of entertainment is not confined to any one line, vaudeville, comic opera, stock and minstrel companies have all met with success.

The outdoor attractions of a permanent nature are figure-eight roller coaster, that has done a most profitable business ever since being installed, a $6,000 carrousel, a laughing gallery, a cave of the winds, a house of trouble, and many smaller attractions. The park is well provided for in the way of refreshment stands. Many additional attractions are being arranged for the coming season, all on a percentage basis. This has always been the policy of the company and nothing has ever been installed that has not made money. The park has 100,000 people to draw from and is the only place of amusement near Chattanooga open throughout the summer season.

No intoxicants are sold or allowed on the grounds. Only the strictly recreative amusements are operated on Sunday, no performances being given. There are band concerts throughout the season and moving picture and illustrated song performances are also given, for which no charge is made. Last season the management found that exhibitions of fireworks drew very well.

Ordinarily no admission is charged to the park except on special occasions when extra attractions are provided. At such times a charge of ten cents is made which usually about covers the extra expense.

In the same enclosure as Olympia Park is a fine half-mile race track, where races and other sports are held. The policy of the management is broad and invites propositions at all times from amusement people in all legitimate branches.

Wonderland.

Wonderland, which is owned by the Illinois Traction System, was first operated during the summer of 1904 under the name of Wayside Park. At that time the park included several acres of ground and contained a small theater. During the summer of 1905 the park was considerably enlarged, embracing about 15 acres, and was operated by the Danville Amusement Co., of which H. L. Brenig is the manager. The name of the park was then changed to Wonderland.

The park is located about two miles southwest of Danville, Ill., on what is known as the Georgetown division of the Danville, Urbana & Champaign Ry. The old theater was enlarged and remodeled and will now accommodate about 1,000 patrons. It is well-equipped for the purposes of such a park, all the seats being on the ground floor, and is well provided with exits. In regard to the class of entertainment which has proved most remunerative, the management considers that such attractions as Elery's Band, the Fall of Port Arthur, the Castle Square Opera Co. and other performances of this nature drew the largest crowds. Balloon ascensions and similar outdoor performances also drew largely, but appealed to a rather different element.

An old mill, a restaurant, a laughing gallery, a small zoo and other attractions appropriate for such places of amusement have been installed. There is also a ball park in the rear of the grounds, which has proved a very desirable feature.

The name of the Inter-Urban Railway Co., of Des Moines, Ia., is to be changed to the Des Moines & Central Iowa Ry.

The Austin Electric Railway.

In several recent issues of the "Street Railway Review" there have appeared articles descriptive of street railway properties, which after periods of successful operation accompanied by the natural depreciation, have been rebuilt to conform with up-to-date standards. Among such properties may be mentioned the city systems of Topeka, Kan., and Madison, Wis. In a class with these two properties is the street railway system of the Austin Electric Railway Co., at Austin, Tex.

Each of these roads has passed through a period of natural growth and each has been rebuilt during the past year. Topeka, Madison and Austin are the capital cities of their respective states and being of about the same population can be considered in the same class. In each of these cities the replacing of old, though well-kept track and overhead and rolling stock with new construction and cars of a heavier and therefore more substantial design, has brought about such a satisfactory increase in the net earnings of the individual properties that the wisdom of the added expenditure for reconstructing the system has been clearly proved.

The lines comprising the Austin city system have a total length of 16.2 miles and on all the streets with the exception of Congress Ave. are built as single tracks with diamond turnouts. On Congress Ave., which is an unusually wide street, leading from the front of the state capitol building through the business district of the city, is the double track line which recently has been rebuilt in a very thorough manner. As a rule the grades in Austin are not severe, the maximum grade being 5 per cent for a length of 500 ft.

Track Work.

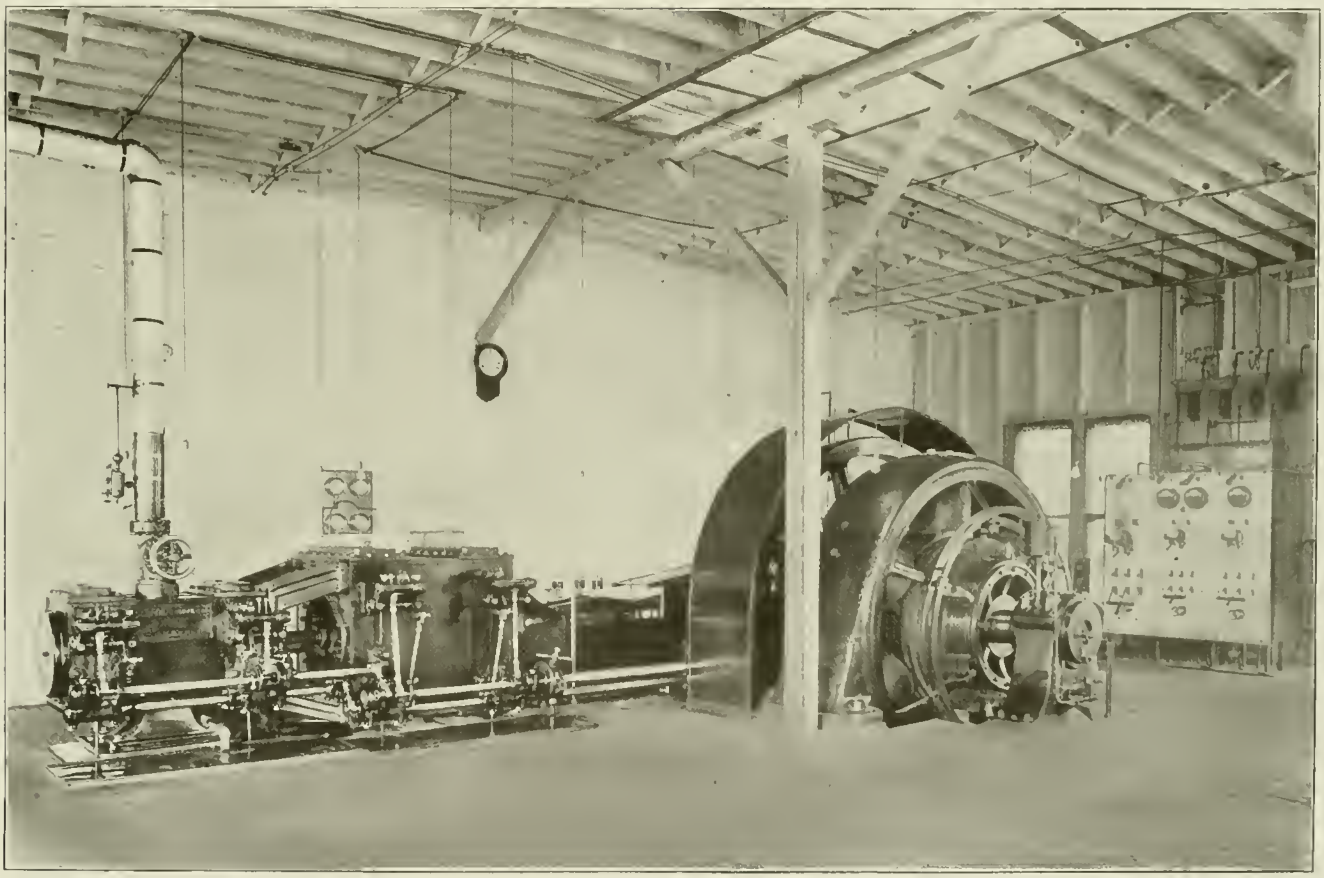
In rebuilding the lines a 55-lb. T rail with single-track construction was used throughout the city, except in the business district. The substructure for this rail consists of ties spaced with 2-ft. centers and half buried in crushed stone ballast which has a minimum depth of 6 in. below the bottom of the ties.

The double-track line on Congress Ave. and the single-track branches in the business district are built with 72-lb. Shanghai T rails 6 in. high in 60-ft. lengths standard, anchored to a concrete substructure, combining the trench and flatbed types of construction.

Some of the accompanying engravings illustrate the different stages in the construction work of this track on Congress Ave. A general view of the avenue with the state capitol building in the distance shows the first stage of the work with the trench gang excavating the street to the desired section and depth for the concrete sub-structure. Another view shows the completed excavation and the rail crew placing the steel on temporary blocks in the trenches. The next stage is also illustrated showing the rails blocked up to line and gage with the tie rods adjusted ready for the concrete crew. In this same illustration the track to the right is shown with the mass of concrete brought up to its proper surface ready for the sand cushion and the bricklayers. In this type of construction the rails are anchored to the sub-structure by special anchors placed in the concrete 10 ft. apart and made of two 1½ x 10-in. bolts and ½-in. plates. Between these anchors, which are hung on the base of the rail while the concrete is being placed, ordinary track spikes are spaced two feet apart on alternate sides of the base of the rails.

On top of the concrete bed, the mass of which is brought up and tamped firmly over the base of the rail, there is placed a sand cushion one inch deep which supports the paving brick. The method of placing the gage bricks is shown in one of the illustrations, where it will be noticed that special notched bricks are used.

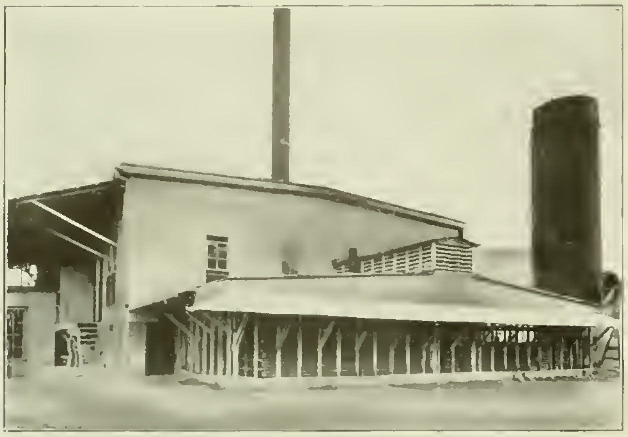
The concrete bed, which is 7 ft. 4 in. wide, is from 10 to 12 in.



ENGINE ROOM, SHOWING 300-H. P. ENGINE WITH DIRECT-CONNECTED GENERATOR.

deep under the rails. The concrete was mixed with Iola portland cement, each car of which was carefully tested before being used.

The mixture is 1 part cement, 2½ parts sand and 5 parts crushed rock. Extraordinary care was taken to secure the best possible materials in making this concrete, which carries not only the street railway tracks, but also the paving between the rails and one foot outside the rails. The crushed rock was selected after an examination of all the quarries within five miles of the city and is the hardest material found. Clean, sharp sand was secured by excavating the



CONDENSING PLANT AT THE REAR OF THE POWER HOUSE BUILDING.

sand bars in the bed of the Colorado River. All paving was carefully grouted with portland cement and sand mixed half and half.

All of the switches and special work in the new construction were built by the Falk Co., Milwaukee, Wis., of 6-in. 72-lb. Shanghai rail with steel-bound frogs, and practically all of the special work in the entire system was replaced with new work, employing long radius curves and switches.

In reconstructing the Congress Ave. double-track line, on which the trolley wires are supported with center-pole construction, it was necessary to shift these steel poles in some instances several feet. This was accomplished by the use of the wagon and chain block shown in one of the illustrations. Trenches were dug, the poles supported by the extending arm on the wagon and then drawn into proper position by moving the wagon. The tracks on Congress Ave. are laid 11 ft. 6 in. center to center, so as to give ample clearance between the cars and the center poles, and avoid accidents to passengers by collision with poles.

That overhead work which is of span construction, consists of a single No. 0 trolley wire supported by steel strand span wires be-

CONGRESS AVE., AUSTIN, TEX., SHOWING TRENCH CREW AT WORK.

tween cedar poles. The trolley wires are supplemented by four similar wires for a short distance from the power house. From this point three feeders extend for a distance of 4,500 ft. as branches on the various lines and off these branches are two feeders 2,520 ft. long and one 18,720 ft. long which are all of No. 00 or No. 0 copper.

Equipment.

The passenger equipment includes 10 Brill convertible cars and 10 closed cars. The convertible cars are 30 ft. 8 in. long and 7 ft. 10 in. wide. The closed cars are 29 ft. 5 in. long and 7 ft. 2 in. wide. There have recently been received from the John Stephenson Co. three 14-bench open trail cars of the type illustrated.

The seating capacity of the cars is 70 passengers, the seats being

DERRICK WAGON USED IN SHIFTING POLE LINE ON CONGRESS AVE.

reversible and of ash and cherry slats. The interiors are finished in ash with cherry mouldings. The sashes in the bulkheads are arranged to drop into pockets between the seats, and three-bar guard rails are used. The curtains may be pulled down to the floor, the Brill round-corner seat-end panels which are used being arranged in connection with the grooves in the posts so as to permit the curtains to come down over the post outside of the panels, a continuation of the grooves of the posts being formed in the exterior surface of the panel. The cars are mounted on Brill No. 420 trail trucks, having a 4-in. wheel base and 24-in. wheels. They are intended for city and suburban service.

The cars measure 37 ft. 10⅜ in. over the crown pieces and from panel over crown piece, 4 ft. Other dimensions are: Width over sills, 7 ft. 4½ in., and over posts at seats, 8 ft. 2 in.; sweep of posts, 5 in.; side sills, 4¾ x 7 in., and the sill plates are 8 x ¾ in.; thickness of corner post, 3⅝ in., and of side posts, 2¾ in.

The equipment of the motor cars includes two 50-h. p. G E-54 motors. The climate at Austin is so mild that heaters and snow plows are not required. The service given requires 25 conductors and 15

RAIL CREW PLACING STEEL IN EXCAVATION.

motormen for handling the equipment, each class of men receiving 16 cents per hour and working for 12 hours each day.

Car House and Shops.

The car house is located on the same property with the power

house and the repair shops. The car house covers a ground area of 190 x 55 ft., having a capacity for 25 cars. This building is constructed of galvanized iron roofing throughout. It has five main tracks, the opening over each track at the end of the barn being protected by a rolling steel door. The repair shop at the plant is a brick building with accommodations for three cars. These two buildings are located side by side with the power plant at their rear which arrangement offers several economic advantages. There are three men employed in the car house whose duties consist of inspecting equipment and making minor repairs.

CAR BARN AND REPAIR SHOP OF THE AUSTIN ELECTRIC RY.

The general repair shop for maintenance of the equipment has a floor area of 100 x 70 ft. and contains three repair tracks. The tools for repair work include three rip saws, one band saw, planer, wood lathe, large steel dressing lathe, bed plane, drill press, wheel press, portable crane and the necessary equipment of smaller tools for repairing cars, armatures, etc. An accompanying illustration is a general view of the car house and the nearby repair shop.

Power House.

The power station building as illustrated covers a ground area of rectangular shape 98 ft. long x 55 ft. wide. The interior of this building is so divided that there is an engine room 46 ft. sq. and a boiler room 46 x 40 ft. in size. The building is constructed with a timber frame supporting galvanized iron siding and a plank and gravel roof. The partition wall between the engine and boiler rooms is of brick so that it serves as a fire wall. The interior of the building is well lighted by large side windows and by skylights with monitors over the peak of the roof. The interior walls are white, which as may be seen in the accompanying illustration, presents a very neat appearance.

ONE TRACK READY FOR CONCRETE AND ONE WITH CONCRETE PLACED.

BRICKLAYING CREW COMPLETING THE PAVEMENT.

The boiler equipment consists of three water-tube boilers each of 175 h. p. capacity. Steam is generated at 125 lb. pressure and delivered through asbestos covered piping to the engines. It is interesting to note that Texas coal is used for steaming purposes being brought directly to the power station siding and purchased at a price of $1.18 per ton. This coal is known as Rockdale lignite.

Included in the power plant equipment is a surface condenser and the cooling tower shown in the exterior view of the power plant. As

Form 1.

AUSTIN ELECTRIC RAILWAY CO.

190	This year.	Last Year.	Cars	LINE	RECEIPTS
Receipts this day,	$	$		Main	$
Increase,	$	$		Belt	$
Total this month to date,	$	$		East & West	$
Increase,	$	$		Blind Inst.	$
Temperatures (Taken 6 p. m.)				Total	$
Weather,				Ticket Sales	$
Cash Balance	$			Advertising	$
Checks as per reverse side,	$		Gross Earnings		$
Net Cash Balance	$		Motor 18-hour cars operated,		
			Trailer 18-hour cars operated,		

Remarks

Signed

(Over)

FORM FOR DAILY REPORT OF OPERATION. (ORIGINAL 6 X 3½ IN. IN SIZE.)

will be seen by reference to the illustration the condenser is built outside of the power house proper and not enclosed. The piping is protected from the sun by a roof with a monitor, but the side walls are open, allowing the free circulation of air. The cooling tower of the admirality type stands on a concrete foundation close to the condenser. The cooling air for the tower is blown in to the side of the shell by belt-driven fans.

In connection with the boiler equipment is a tall steel stack built on an independent foundation outside of the building, and connected with the battery of boilers through an underground breeching.

There are two engines, one of the horizontal-tandem type as illustrated, direct-connected to a 200-kw. railway generator, the engine being rated at 300 h. p. Another engine of 200 h. p. drives two generators of 80 kw. capacity each.

The current output of these machines is controlled by suitable apparatus mounted on a marble switchboard of three panels. The average daily load requires about 43,000 kw. h. output, with an average car mileage of 135.65 miles per day.

Among the number of printed forms used in the operating accounts

OPEN TRAIL CAR FOR AUSTIN, TEX.

of the railway is the daily business report reproduced herewith This report is printed on a sheet 6 x 3½ in. in size, both sides of the paper being used. On the reverse side from that shown are rulings suitable for listing the checks drawn on the company's account for the day stated on the front of the sheet. Suitable columns are ruled for number, amount, account and to whom payable, with space for listing about 12 checks.

The officers of the Austin Electric Railway Co. are: Wilber H. Young, president and general manager; Franklin H. Watriss, vice-president; C. V. Peel, secretary; E. T. Wilmot, treasurer; W. H. Burdett, superintendent of equipment; Joseph M. Aday, chief engineer; Julius Eggeling, electrical engineer; C. Ing, superintendent of transportation. The Columbia Construction Co., of Milwaukee, Wis., is consulting and constructing engineer for the Austin Electric Railway Co., and has had charge of the recently completed construction work.

Mutual Traction Insurance Plans.

During the past two years, a thorough study of the best plan for lowering the cost of insurance on electric railway and lighting properties has been made by interests centering in Cleveland, O. After considering the matter in a careful way, a number of the leading traction managements have decided that it is not only practicable but advisable, for traction companies to perfect an insurance organization for safeguarding their properties against loss by fire. With this end in view, there have been organized the American Railway Insurance Co. and the Associated Railway Companies Insurance Co., each with a capital stock of $200,000 and a surplus of $300,000. These new companies embody mutual features and their control will be in the hands of a number of important traction interests. It is planned to write both "protected" and "unprotected" risks, taking the present rate of the stock insurance companies as a basis, and granting a reduction in rates where the properties are equipped with fire-protection appliances.

The Traction Mutual Insurance Co. and the Electric Mutual Insurance Co., also have been incorporated under the laws of Ohio, but will be conducted strictly along mutual lines. The entire capital stock and surplus of these companies will be contributed by those interested in railway and lighting properties, and the business written will be confined exclusively to such properties and kindred risks. After paying the actual losses and expenses, it is proposed to return all unearned premiums to the policy holders, thus reducing their insurance to actual cost. It was not considered wise for the mutual companies to begin operating until a total value of $20,000,000 of protected risks could be underwritten. For this reason the stock companies were organized and will handle risks as earlier mentioned.

The promoters and incorporators of the stock companies are: Horace E. Andrews, president of the Cleveland Electric Railway Co.; Henry A. Everett, president, Northern Ohio Traction & Light Co.; A. E. Akins, vice-president, Cleveland & Southwestern Traction Co.; Warren S. Bicknell, president, Cleveland Construction Co.; Chas. W. Wason, president, Cleveland, Painesville & Eastern Traction Co.; C. G. Goodrich, vice-president, Twin City Rapid Transit Co.; J. C. Hutchins, president, Detroit United Railway Co.; John J. Stanley, general manager, Cleveland Electric Railway Co.; H. J. Davies, secretary, Cleveland Electric Railway Co., and director of The Factory Mutual Insurance Co.; T. H. Hogsett, attorney and director of The Factory Mutual Insurance Co., and Henry N. Staats, underwriter and manager of the Associated Railway & Light Companies' Insurance Inspection & Survey Bureau. The offices of the manager are at 901-902 Citizens' Building, Cleveland, O.

In December, 1904, H. J. Davies, secretary of the Cleveland Electric Railway Co., mailed to each street railway company in the United States and Canada a letter, requesting a report showing the amount of money paid for fire insurance during each of the past ten years, the amount of losses sustained, and the amount actually recovered from insurance companies. Reports were received from about 420 companies, indicating that for the past ten years the total amount of premiums paid by these companies was $6,049,641; losses, $1,971,806, or 32.59 per cent of the premiums paid; amount recovered $1,673,336 or a percentage of loss to premium paid of 27.66 per cent. A similar compilation was made by J. H. Neal, president of the New England Street Railway Club, during the same year, but confined to New England companies for the same period of 10 years. The results showed that of a total of $1,016,524 paid in premiums, but 23.5 per cent or $239,170 was received for fire loss. These investigations have had much weight in deciding whether or not mutual insurance can be made successful among traction and lighting companies.

A company is being organized to build an electric line from Cape Girardeau to New Madrid, Mo.

Parks of the Rochester Railway Co.

The city of Rochester, N. Y., is favored with as many pleasure resorts as any city of equal size in the United States. Nature, by means of the beautiful waters of Lake Ontario, Irondequoit Bay and the Genesee River, has made them especially attractive. The parks reached by the lines of the Rochester Railway Co. are, Glen Haven, Sea Breeze, Windsor Beach, Summerville, Ontario Beach, Manitou Beach and the city parks, Genesee Valley and Seneca. Glen Haven, Sea Breeze, Windsor Beach and Summerville are controlled and operated by the Rochester Railway Co., under the special management of B. E. Wilson, the general passenger agent.

Glen Haven is located at the head of Irondequoit Bay, three miles and a half from the city and is reached by the Rochester & Sodus Bay Division, of the Rochester Railway Co. The road is double-tracked and almost the entire right of way is through a beautiful glen. This resort is conducted along the lines of the most modern amusement parks, and possesses such features as the figure-eight toboggan, merry-go-round, Katzenjammer castle, temple of mirth, cave of the winds, house of trouble, trip to the north pole, the bumps, etc. The possibilities of electricity have not been forgotten, and Glen Haven, with its thousands of incandescents, is a brilliant sight after dark.

The park has no theater proper and the forms of entertainments that would naturally be given in a theater are given on the Circus Maximus, a large open circular stage or platform, backed by a series of elevations which make a good band stand. Added to these elevations on either side are two artistic towers serving as dressing-rooms for the performers. The most successful attractions during the past season were band concerts and standard vaudeville, especially the big animal acts. Any attraction that pleased the children seemed to assure a big attendance at the park. One special feature that has added to the popularity of Glen Haven has been the placing of benches in all parts of the grounds.

Sea Breeze Park is situated on a high bluff overlooking the waters of Lake Ontario and Irondequoit Bay and contains 40 acres of rolling lawns, shady groves and picturesque ravines. No pains have been spared in assisting nature to make this resort one of the most attractive in the vicinity of Rochester. It is owned by the Rochester & Suburban Railway Co., which is at present operated by the Rochester Railway Co. The trolley ride from Rochester to the park is eight miles in length, the cars in use being of the large, open, cross-seat type.

Sea Breeze Park is the picnic resort of western New York, and from the day the schools are closed until they are opened in the fall, the park is the scene of many picnics. The park is so arranged that as many as ten large picnics can be accommodated in one day and still each picnic is practically by itself. The average number of picnics per day for the past season was six. The feature that has made the park so popular with picnics has been the free pavilions, which have been specially constructed with fully equipped kitchens, hot and cold water, dishes, ice and an attendant to assist the picnickers, all of which is furnished free of charge.

THE CIRCUS MAXIMUS AND KILTIE'S BAND, AT GLEN HAVEN PARK.

The ball grounds which are kept in regulation form, add much to the popularity of the park. Except the zoological gardens, merry-go-round, laughing gallery, pony track and photograph gallery, the only attractions offered are band concerts. The park is thoroughly policed, and good order is demanded. A fine bathing beach also adds to the popularity of the park.

Sea Breeze and Glen Haven, though located at opposite ends of Irondequoit Bay, are brought into close relation by an excellent service of electric and naptha launches and steamboats. Tickets are sold by the railway company, covering transportation in either direction on both the Glen Haven and Sea Breeze lines, as well as the boats.

Windsor Beach or the "White City," as it is better known to the people of Rochester, occupies a beautiful bluff overlooking Lake Ontario and is reached by a 30-minute trolley ride from the city.

The entire resort is surveyed into hundreds of cottage lots, the streets, as near as possible, all running to the lake front. With the exception of a few lots that have been sold, upon which summer homes have been built, the Rochester Railway Co. controls the entire

park. Each summer the lots are rented out at a small figure to families for camping. The company has installed a waterworks and lighting plant, and during the summer months, when the hundreds of tent cottages are up, the resort is indeed a "White City."

Summerville, like Windsor Beach, is a village of cottages and is located on the shore of Lake Ontario at the mouth of the Genesee River. It is reached by a delightful trolley ride, following a beautiful boulevard along the east bank of the Genesee River.

The main attraction of Summerville is the bathing beach, where during the warm summer days, hundreds enjoy the excellent surf bathing.

Summerville is directly opposite Ontario Beach, the two resorts being separated by the mouth of the Genesee River. Service between the two is effected by means of a large ferry boat also controlled by the Rochester Railway Co. At Summerville is located the United

ATTRACTIONS IN DREAMLAND, GLEN HAVEN, N. Y.

States Life Saving Station which is always an object of interest to visitors at Rochester.

Ontario Beach Park is a large amusement resort which has of late gained the title of "The Coney Island of western New York." All sorts of amusements are furnished and as a result the park is favored with a large patronage. The New York Central Railroad Co. during the summer season carries many excursions to this point from all parts of the state.

The traffic arrangements to the park are excellent. The two double-track lines operated by the Rochester Railway Co. to this point, together with the frequent train service offered by the New York Central Railroad Co., make the handling of large crowds an easy proposition.

The hotels at Ontario Beach are specially constructed for the

LOOP TRACK AND ENTRANCE TO GLEN HAVEN PARK, ROCHESTER RAILWAY CO.

handling of summer boarders. Two exhibitons of fireworks weekly have proven very strong drawing cards at this park.

Manitou Beach is a picnic resort, reached by a trolley ride of eight miles from Ontario Beach along the lake shore.

The park system of Rochester embraces approximately 630 acres divided among the principal parks. The entire system including the city public squares are easily and quickly reached by means of the Rochester Railway Co.'s lines. The company has found it very profitable to co-operate with the city officials in making the parks especially attractive. The company contributes liberally towards paying for band concerts and other amusements that are consistent with city parks.

The Parks of the Boston & Northern and Old Colony Street Railway Companies.

BY R. H. DERRAH.

From twelve to fifteen years ago when the rate of building suburban trolley lines was fast increasing a pleasure resort or park was

SCENE IN HIGHLAND PARK, SHOWING OBSERVATION TOWER.

considered a very important adjunct to the earning power of the road, and at one time no less than 45 of these resorts were owned and maintained by the suburban lines of New England, mostly in Massachusetts. These natural groves richly endowed by nature, were located on the banks of rivers, lakes or the ocean shore, and laid out with pretty walks, beds of flowers, and shrubbery. Each was equipped with summer houses, a band stand, dancing and dining pavilions. The swings and rustic seats scattered throughout the shady nooks made them ideal places for picnic parties and recreation grounds for the masses. In several were found rustic theaters where entertainments were given afternoons and evenings during the sum-

ADVERTISING CAR, BROCKTON, MASS.

mer season. Today, not more than 15 up-to-date street railway parks are maintained in the state. This decrease in number was brought about partly by the consolidation of the various small roads, and also because some of the parks were found unprofitable on account of the lack of population to draw from.

There are few, if any of these parks that can show credit balances at the end of the year. The increased passenger traffic without doubt offsets in many cases the park deficit figures, nevertheless there is al-

ways a question whether or not these parks are profitable when the expense incurred to obtain the increased riding, is taken into consideration.

The Boston & Northern and Old Colony Street Railway lines are so located, that their park business is but a very small portion of their summer pleasure riding, and cannot be classed with suburban roads that depend principally on the popularity of their parks for increased business.

These two companies operate 880 miles of track north and south of the city of Boston, serving no less than 22 cities and 66 towns in the states of New Hampshire, Massachusetts and Rhode Island. They reach all the rocky shores, the beautiful beaches that offer unrivalled facilities for bathing, as well as all kinds of amusements, and other sections of the north and south shores of Massachusetts Bay that are attractive to the tourist. The lines travel along more delightful rivers, and valleys, past the shores of more lakes and through more historical cities and towns than can be found in any other section of the country, and the pleasure travel is increasing wonderfully as these delightful and historical places are brought to the stranger's attention.

The Boston & Northern and Old Colony Co's. do, however, own and maintain a large group of pleasure resorts, having no less than ten. Seven have well equipped rustic theaters besides the usual park attractions, and are under the direct supervision of the companies. Six are located within the limits of a five-cent fare from the city from which they obtain their greatest patronage.

Sabbatia Park is but a short distance from the center of Taunton, a city of some 31,000 inhabitants; Highland Park is near Brockton, the greatest shoe manufacturing city in the country, with a population of 48,000, and surrounded by many small enterprising towns which patronize the entertainments during the summer. A 30-minute ride out of the mill city of Lowell with its population of 95,000 is Lakeview Park, located on the banks of a beautiful lake, with the city of Nashua, N. H., within a 45-minute ride to draw from. Glen Forest is only 15 minutes ride from the business center of Lawrence, another mill city in the Merrimac Valley, whose population of 72,000 will within two years be increased to about 90,000. Further down the valley near the city of Haverhill is "The Pines" on the banks of the Merrimac River. Haverhill is another progressive shoe manufacturing city with a population of 44,000. Long Beach is but a 20-minute ride out of the city of Gloucester on the Atlantic coast. Westwood Park is located in the town of Dedham, one hour's run from the terminal of the Boston Elevated R. R.

ARTISTIC ENTRANCE TO HIGHLAND PARK, BROCKTON, MASS.

The seating capacity of the theaters in these parks varies from 1,200 to 3,500.

The same policy that had been pursued for many years in the attractions at the parks was carried out here. The parks were opened to the public on a certain day with the same old program consisting principally of vaudeville with the results that the patronage gradually fell off from year to year. The companies began to realize that the public demanded entertainments of a higher order, and in the early part of 1905 a radical change was decided upon. The parks were greatly improved, the seating capacities of the theatres enlarged, and several new attractions such as roller skating, shooting galleries, merry-go-rounds, etc., were added. An elaborate program was successfully carried out on the opening night and brought out a record breaking crowd which appreciated the efforts of the company. The substitution of operas, operattas, farce and musical comedies with other additional amusements, for the vaudeville of former years increased the popularity of the parks notwithstanding the fact that the admission to the theaters had been increased.

MONARCHS OF THE FOREST AT SABBATIA PARK, STAUNTON, MASS.

Lowell, Lawrence, Haverhill, and Brockton are all large manufacturing centers and a show favorably received at one place was sure of the same reception at the other three. This was not the case with Taunton where vaudeville seemed to have the call over all, and this they were supplied with. Long Beach and Westwood Park were provided mostly with vaudeville. The efforts of the companies to give better entertainments and run the various resorts on a higher plan proved so popular that the increase in attendance at one was 110 per cent over the previous year, another one 75 per cent, the third, the most beautiful natural park of them all, never showed to better advantage, while the fourth and fifth showed a gratifying increase.

The methods of advertising played no little part in bringing about such results. While the straight advertisements in various papers did not exceed in cost of those of previous years, they were, however, kept up to date and not neglected, and the public was posted from day to day of the happenings and attractions through generous reading notices. Flyers were also printed and distributed from the cars. The five advertising cars (see photograph) were kept on the lines afternoons and evenings during the summer season and certainly did a great deal of good.

In order to make these resorts popular in the winter as well as in the summer, toboggan chutes, artificial skating rinks, log cabins, and other attractions were installed. Several hockey teams have been formed in the different cities, and arrangements have been made to have matches between these clubs, speed and fancy skating races, and many other ice and toboggan sports, ending up with fancy dress carnivals at the different parks, but the weather so far has certainly not been as propitious for making the resorts magnets of attraction in the way of outdoor sports, as would be the case if the winter were more assertive in manifesting its presence.

Additional improvements will be made at the parks the coming

spring. Plans have already been made for the construction of a large roller coaster at Highland Park and one at Lakeview Park.

As previously stated it requires a constant change of policy as well as entirely different forms of entertainments to interest the public. This, the street railway company must do in order to obtain and keep the good will of its patrons.

Meeting of the Executive Committee of the American Street & Interurban Railway Association.

The Executive Committee of the American Street & Interurban Railway Association met at the association headquarters, 60 Wall St., New York City, on February 6th. Those present were Hon. W. Caryl Ely, president Ohio Valley Finance Co., Buffalo, N. Y., John I. Beggs, president Milwaukee Electric Railway & Light Co., Milwaukee, Wis., James F. Shaw, president Boston & Worcester Electric Co's., Boston, Mass., W. B. Brockway, auditor Nashville Railway & Light Co., Yonkers, N. Y., H. H. Adams, president accountants' association and superintendent of shops United Railways & Electric Co., Baltimore, Md., S. L. Rhoades, president Railway Engineering Association and general claim agent Philadelphia Rapid Transit Co., Philadelphia, Pa., and Bernard V. Swenson, secretary and treasurer of the American Street and Interurban Railway Association.

The meeting was called for the purpose of considering a number of important matters relating to the American Street & Interurban Railway Association, and the affiliated associations. The secretary presented a report to the committee covering the various association matters which have taken place since the convention at Philadelphia in September, 1905. Some of the things enumerated, which have occurred since the convention are the following:

The meeting of the Executive Committee held Sept. 29, 1905, at Philadelphia, at which time the secretary and treasurer was appointed. The minutes of this meeting were read and approved. The secretary stated that investigations had been inaugurated immediately upon the close of the convention, to obtain desirable offices for the association headquarters. Temporary offices were obtained at 114 Liberty St., and permanent headquarters, at 60 Wall St. The secretary spoke of the general office assistance, of the equipment, and of the work which has been carried on during the past few months. Circular letters in relation to compensation for carrying United States mail, together with printed data sheets, were sent out in December to all of the electric railways in the United States, Canada and Mexico, the total number being approximately 1,200 Similar circular letters were sent out the latter part of December, together with a data sheet relating to the speed of interurban cars in towns and cities. Up to the present time, replies from these inquiries have been coming in continuously and a large number are now on file in the secretary's office. Data sheets relating to the official mailing lists of the various member companies have also been sent out.

Personal typewritten letters were sent to the various member companies in the latter part of December and the first part of January, outlining the work of the association, as conducted under the new conditions resulting from the reorganization. In answer to this communication, the president and secretary have received a large number of letters from various railway people connected with the companies throughout the country. These letters have universally heartily endorsed the work of the association. The association has already established a correspondence with over 400 different people since the establishment of the office. More than 4,000 letters have been written in the ordinary correspondence.

Membership Committee.

The membership committee has sent out two circular letters to non-member companies, one on September 15th and the other in January, 1906. These letters were in all cases signed by H. H. Vreeland, chairman of the membership committee. As a result of this work, 49 new companies have already joined the association, and letters are still being received in this connection.

Insurance Matters.

Some considerable work has been done on the question of insurance, much of which has been accomplished by the chairman of the insurance committee. This committee consists of H. J. Davies, Cleveland, O., chairman, and R. B. Stearns and T. C. Penington of Chicago, Ill. Mutual insurance companies are being formed, and it is believed that the insurance question, from the standpoint of the street railway companies, will be very materially bettered by the work of this committee.

Annual Report.

The annual report of the association is still in the printers' hands, but will be ready for distribution within a short time. The report of the railway engineering association has already been distributed, and that of the accountants' association will be ready for distribution within a week or ten days.

Relations with State and Sectional Associations.

The president and secretary have devoted some considerable attention to the question of state and sectional street and interurban railway associations and their relation with the national association. They attended the meeting of the Massachusetts Street Railway Association in Boston, on Dec. 13, 1905. This was the 23d anniversary of the establishment of the American Street Railway Association and proved to be a very interesting and profitable meeting. The secretary attended the first quarterly meeting of the New York State Street Railway Association held at Schenectady on January 10th. The president and secretary attended the first annual convention of the Central Electric Railway Association held at Dayton, O., on January 24th. The attendance at these meetings of the officers of the association is believed to be conducive to a much closer relation between the various electric railway interests of the country.

Among the other important matters which were considered by the executive committee, were the following:

Approval of the constitutions and by-laws of the affiliated associations. These constitutions and by-laws were presented at the meeting and after some discussion, the matter was referred to the presidents of the various affiliated associations together with the secretary of the "American" Association, with power to act. W. Bordman Reed, maintenance-of-way engineer for the New York City Railway Co., was invited to attend the meeting to confer with the committee on the matter of constitution and by-laws of the Railway Engineering Association.

The 1906 Convention.

The date and location for the 1906 convention was discussed at considerable length. Invitations had been received from Atlantic City, Denver, San Francisco, Chattanooga, Atlanta and Put-in-Bay. No definite convention city was decided upon, but the matter was left to the president, vice-president Shaw, and the secretary to investigate and report at the next meeting of the execuive committee. Messrs. Baker and McGraw of the manufacturers' association were invited to confer with the members of the committee in this matter and were present at the meeting.

Standing and Special Committees.

At the Philadelphia convention committees on membership, insurance and rules for car wiring were appointed. In addition to these committees the president was authorized at the meeting to appoint a committee on "Papers and Topics." This is a very important committtee and it is expected that much work will be done by it within the next few months, as it is the desire of the executive committee to have some valuable papers presented at the next convention.

In this connection it is to be remembered that according to the new scheme of co-operation, many of the technical topics discussed at the previous meetings of the "American" Association will now be considered before the proper affiliated associations. Other matters considered related to the distribution of the proceedings for the current year, the binding of the proceedings of past years, and the privileges of associate membership.

The Boston & Worcester Street Railway Co. has recently issued its winter time table between Boston and Worcester and intermediate points. Besides the time tables the publication includes a map of the system, rates of fare and the usual information regarding special cars, lost articles and tickets. The pamphlet is of convenient size for carrying in the pocket and is gotten out by the passenger department of the company, of which Mr. A. E. Stone is general passenger and ticket agent.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Kenfield Publishing Co. under the title "Street Railway Law," five volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901 to 1903; Vol. V. from April, 1903, to August, 1905. Price: Bound in sheep; five volumes, $12.00; single volume, $3.00. Bound in buckram; five volumes, $8.00; single volume, $2.00.]

TRANSFER TICKET MUTILATED BY PASSENGER MAY BE REFUSED UNDER RULES.

Koch vs. New York City Railway Co. (N. Y. Sup.), 95, N. Y. Supp. 559. Oct. 27, 1905.

In affirming a judgment for the company, the appellate term of the supreme court of New York says that the finding in its favor was supported by evidence that the transfer ticket in question was mutilated after it came into the plaintiff's possession, and thus lost its character as a token of his right to passage, within the reasonable rules adopted by the defendant. If mutilated when it was given him, this ticket would have sufficed, and the defendant could not properly have refused it; but there was evidence to the contrary, and the court cannot say that better credit should have been given to the interested testimony of the plaintiff.

CARE REQUIRED IS THAT CONSISTENT WITH THE PRACTICAL OPERATION OF THE ROAD.

Tri-City Railway Co. vs. Gould (Ill.), 75 N. E. Rep. 493. Oct. 24, 1905.

The supreme court of Illinois holds that an instruction to the jury was erroneous which did not limit the degree of care required of the carrier to such care as was consistent with the practical operation of the road. In other words, it says, that part of an instruction which told the jury that "the defendant, through its servants in charge of such car, was required to do all that human care, vigilance, and foresight could reasonably do, in view of the character and mode of conveyance adopted, to safely carry him as such passenger," should have read as follows: "The defendant, through its servants in charge of such car, was required to do all that human care, vigilance, and foresight could reasonably do, in view of the character and mode of conveyance adopted, and consistently with the practical operation of the road, to safely carry him as such passenger."

SUFFICIENCY OF EVIDENCE THAT CAR WAS NOT STARTED SUDDENLY AND CARELESSLY.

Lincoln Traction Co. vs. Shepherd (Neb.), 104 N. W. Rep. 882. Sept. 20, 1905.

In an action for damages by a passenger against a street railway company, where the defendant's liability rests upon the question whether or not a street car was suddenly and carelessly started as the plaintiff was about to alight therefrom, which is denied, the supreme court of Nebraska holds that the defendant is only required to furnish sufficient proof to rebut that produced by the plaintiff upon this point, and is not required to establish its freedom from negligence by a preponderance of the evidence.

NO LONGER A PASSENGER WHEN CATCHING FOOT IN FENDER—MAY LET CAR STAND A REASONABLE TIME—RULE REQUIRING MOTORMAN TO STAND AT POST UNTIL CONDUCTOR COMES.

Poland vs. United Traction Co. (N. Y. Sup.), 95 N. Y. Supp. 498. Sept. 26, 1905.

A passenger after alighting from a car at the terminus of its route attempted to cross in front of the car and was injured by catching her foot in the fender. The third appellate division of the supreme court of New York holds that at the time of the accident the company's duty to her as a passenger had ceased. It holds that a street railway company has the right, without being charged with a breach of duty or unlawful obstruction of the highway, to allow its cars to stand upon its tracks for a reasonable length of time. Nor does it think that it helps the situation by saying that the motorman could have immediately lifted the fender with a hook when the car came to a stop. The car was on a downgrade. Inattention to his brakes, necessary to the lifting and strapping of the fender, might have been much more dangerous to passengers and wayfarers. It was not an unreasonable rule which required the motorman to stand at his post until the conductor had finished his duties of seeing to the alighting of passengers and had come to the front of the car.

DUTY TO USE BEST AND MOST CONVENIENT APPLIANCES FOR OPERATION OF ROAD—RIGHT OF RAILROAD COMPANY TO USE ELECTRICITY AS MOTIVE POWER.

Howley vs. Central Valley Railroad Co. (Pa.), 62 Atl. Rep. 109. Oct. 9, 1905.

In the absence of a limitation upon the power of a railroad company to use any appliances, or of a prohibition as to the use of any particular one, the supreme court of Pennsylvania says that it is the duty of the company to use what, in the light of its observation and experience, is best and most convenient for it in the operation of its road, having at all times due regard to the safety of the public which it was created to serve. In such a case its duty fixes the measure of its powers in performing it. What it manifestly ought to do in exercising its franchises it may do, unless forbidden by its supreme law—the will of its creator as expressed in the words giving it life.

This court has, it is true, designated railroads organized under the act of 1868 as steam railroads. But this designation has been adopted only as a natural one, to distinguish such railroads from street pasenger railways, and in no case in which it has been used is there any intimation as to the limitation upon the power of a railroad company in the adoption of its motive power. With the question now before the court as to the right of a railroad company incorporated under the general railroad act to use electricity as a motive power, the court is clear that the defendant company is not prohibited from using electricity as a motive power, and if, in its judgment, the same ought to be used for the most efficient exercise of its right to operate its railroad, it may be used.

CARE REQUIRED AND DUTY TO REGULATE SPEED WHERE A CAR IS OVERCROWDED.

Alton Light & Traction Co. vs. Oliver (Ill.), 75 N. E. Rep. 419. Oct. 24, 1905.

The servants of the company, the supreme court of Illinois says, invited passengers to occupy a car beyond its capacity, and knowingly permitted, if they did not induce, passengers to stand on the platforms and steps of the car. In such case the carrier assumes the duty of exercising, for the protection and safety of the passengers, that degree of care that is demanded by the circumstances. The obligation of a common carrier, which rested on this company, was to do all that human care, vigilance, and foresight could reasonably do, consistent with the mode of conveyance and the practical operation of the road, to convey the passengers in safety to their destination. Slight care and foresight only was necessary to arouse apprehension that the passengers on the platforms and steps of the car would be endangered by any excessive speed, and that speed even more moderate than the usual rate of speed was the

more prudent and safe course for the safety of such passengers. It was the duty of the company to regulate the speed of its car in view of the fact that it had encouraged its patrons to overcrowd the aisles, platforms, and steps. The high degree of care which the law enjoined upon it for the safety of its passengers should have been the paramount consideration. The practical operation of the car did not require that a rapid rate of speed should be employed. Whether it was negligence on the part of the plaintiff, as a passenger, to stand on the steps or platform of the car, was a question of fact for the decision of the jury, and not of law to be determined by the court.

ATTEMPTING TO DRIVE ACROSS TRACKS RELYING ON CAR STOPPING TO PREVENT COLLISION.

Chicago Union Traction Co. vs. Jacobson (Ill.), 75 N. E. Rep. 508. Oct. 24, 1905.

If teamsters, generally, may drive across street car tracks between street intersections, knowing that a collision will be inevitable unless a car is stopped, and intending to take precedence over the car and compel those in charge of the car to stop it, the supreme court of Illinois says that the rights of a street car company on its track and of the general traveling public would be invaded and practically destroyed. The law does not permit one in such a place to drive in the path of a moving car, relying upon those in charge of the car to stop it and protect him from injury.

NOT IN POSITION TO COMPEL REMOVAL OF SWITCH.

Taylor vs. Erie City Passenger Railway Co. (Pa.), 61 Atl. Rep. 992. June 22, 1905.

Where township authorities, fearing that by the lengthening of sidings a second track would practically be made on the highway, obtained a decree of court limiting the length which siding might be constructed and requiring the removal of certain ones, the supreme court of Pennsylvania says that they could waive the enforcement of the decree, and did so, by formally permitting the continued use of a switch, which was found by the court to be of great value to the company in the operation of the railway, of great convenience to the traveling public, and occasioning no damage to the trustees under the will of a deceased abutting property owner. But more than four years after the township authorities might have insisted upon the removal of the switch, and more than three years after they had consented to its continuance, the trustees brought this suit to enjoin its use and compel its removal. Even if there had not been an express grant before his death from the property owner referred to, authorizing the construction of the switch, with no objection to it from him or the trustees until this suit was brought, equity would not decree its removal after this great lapse of time and the expenditure of large sums of money in improving the tracks and system, of which the switch formed a part. To the proceeding by the township commissioners these trustees were not parties, and they were not in a position to ask for the enforcement of the decree. They alleged that the defendants were in contempt of it. This question, however, could be raised only by those who were entitled to enforce it.

UNCONSTITUTIONAL ACT REQUIRING SEPARATION OF RACES.

State vs. Patterson (Fla.), 39 So. Rep. 398. July 29, 1905.

An act requiring street car companies to provide separate compartments in their cars for the Caucasian and African races, and that under penalties prohibits persons of either of said races from occupying the compartment of a car set apart for the other race, but with the proviso "that the provisions of this act shall not apply to colored nurses having the care of white children or sick white persons," the supreme court of Florida holds violates section 1 of the fourteenth amendment to the federal constitution, and is void. The court says that it is violative of said section in that it discriminately abridges the privileges and immunities of one class of citizens of the United States by giving to another class of such citizens privileges that are withheld from the class discriminated against. It gives to the Caucasian mistress the right to have her child attended in the Caucasian department of the car by its African nurse, and withholds from the African mistress the equal right to have her child attended in the African department of the car by its Caucasian nurse. It also discriminates between the races, in that it gives to the invalid adult Caucasian man or woman, the right to be attended in his or her department of the car by his or her colored nurse, and withholds from the African invalid the corresponding right to be attended in his or her department of the car by his or her white nurse. It also gives to the African nurse the right to space in either department of the car, and withholds from the Caucasian nurse the same privilege, thereby discriminating between the races in favor of the African nurse as against the Caucasian nurse belonging to the same occupational class of persons.

PRIVATE PROPERTY MAY BE CONDEMNED FOR CAR BARNS AND POWER HOUSE.

Eddleman vs. Union County Traction & Power Co. (Ill.), 75 N. E. Rep. 510. Oct. 24, 1905.

The supreme court of Illinois holds that the company had the right to condemn private property for car barns and a power house to be used in connection with its railroad, as laid in the public streets. It says that this has been settled by Illinois cases in which it has been held that the right of a street railway company to diverge from the highway and go upon private property depends upon the necessities of construction as a question of fact, and that a street railway company, under the horse and dummy railroad act of 1874, may condemn such private property as is necessary for side-tracks, station grounds, power houses, switches, or turnouts necessary to render the use of the highway or street practicable and efficient.

INJURY BY COLLISION TO PASSENGER GETTING ON BUMPER TO LET OTHERS ALIGHT—MOTORMAN BOUND TO KNOW CONDITION OF RAILS AND DANGER OF WHEELS SLIPPING—HALLOOING INSTEAD OF SOUNDING GONG.

Chicago City Railway Co. vs. Schmidt (Ill.), 75 N. E. Rep. 383. Oct. 24, 1905.

A passenger on a crowded car got out on the rear of the car after it had stopped in order to let other passengers alight. He was injured by the car following colliding with the one he was on. The supreme court of Illinois says that if he had voluntarily taken the unusual position in which he was injured for the purpose of riding as a passenger, he might doubtless have been held guilty of contributory negligence. But that was not the case made by the evidence, and whether, in getting out of the way of the passengers desiring to get off the car, he was guilty of negligence was a question of fact for the jury under all the facts and circumstances of the case. The conductor on the second car must be held to have known the condition of the rails and the danger of the wheels slipping. The jury also had a right, in determining the question of his negligence, to take into consideration the fact that he failed to give the usual alarm or signal. If he had rung the gong promptly upon discovering that he could not stop the car, the one in front might have moved forward or the passenger injured might have saved himself by getting off the bumper. Hallooing was not the usual or proper way of giving alarm. The passenger might or might not have heard it, or, if he did, failed to understand what was said. The court is of the opinion that the evidence, though conflicting, fairly tended to show that the rear car was negligently managed, and such negligence caused the injury.

STREET RAILWAY INCLUDED IN MECHANIC'S LIEN LAW COVERING "ANY RAILROAD."

Egan vs. Cheshire Street Railway Co. (Conn.), 61 Atl. Rep. 950. Oct. 6, 1905.

Section 4140 of the general statutes of Connecticut of 1902 by which "any railroad or any of its appurtenances" is included with "any building or any of its appurtenances," as subject to the provisions of the mechanic's lien law, the supreme court of errors of Connecticut thinks, makes the claim of any person who has rendered services as described in said section in the construction of a

railroad structure, such as that in question in this case, a lien upon the property described in said section. The court says that section 4140 is a part of the statute dealing with mechanic's liens. The word "railroad" in the clause in question indicates a structure in the construction of which services can be rendered and materials furnished. The clause is directed solely to the protection of the mechanic's claim for the value of his labor and materials which have gone into the construction of this structure. Every railroad as well as every building, and any railroad as well as any building, in the construction of which a mechanic has rendered services or furnished materials, is subject to the appropriate lien for the security of his claim for such materials and services. This particular protection, first given to the mechanic in 1871, was not limited by the fact that railroads constructed by corporations operating their trains by steam were then many in comparison with those constructed by other corporations, and that the protection of his labor in the construction of railroads of the latter kind was then of slight importance, any more than it is broadened by the fact that, when this mechanic's lien law was re-enacted in the revision of 1902, the conditions had changed and the protection of his labor in the construction of railroads used in the movement of trains by power other than steam had become of great and increasing importance.

VALIDITY OF CITY ORDINANCE REQUIRING FENDERS.

City of Elkhart vs. Murray (Ind.), 75 N. E. Rep. 593. Oct. 10, 1905.

A city ordinance required the use of a particular fender described therein, or some other fender equally as good, to be approved by the common council or street committee. The supreme court of Indiana, assuming that cities of the class to which this one belonged had the implied power to require street cars running within the city limits to be equipped with fenders, holds that this ordinance was not a reasonable exercise of that power. It says that such power, if possessed by the city, must be exercised by ordinance. The ordinance must contain permanent legal provisions operating generally and impartially upon all within the territorial jurisdiction of such city, and no part thereof be left to the will or unregulated discretion of the common council or any officer. If an ordinance upon its face restricts the right of dominion which the owner might otherwise exercise without question, not according to any uniform rule, but so as to make the absolute enjoyment of his own depend upon the arbitrary will of the city authorities, it is invalid, because it fails to furnish a uniform rule of action and leaves the right of property subject to the will of such authorities, who may exercise it so as to give exclusive profits or privileges to particular persons. The ordinance in question, if valid, vested in the common council and street committee an arbitrary discretion, which they might exercise or not at their pleasure. They had the power to approve a fender for use by one street railroad company, and refuse approval of the same fender for use by another company, under the same circumstances and conditions. They also had the power to approve one or more fenders, and refuse approval of other fenders equally as good or better, whether made by the street railroad company or some one else, thus arbitrarily discriminating in favor of some manufacturers and against others. It was the fact that said officers had the power to do this, and not that they would do so, that rendered said ordinance invalid.

RIGHT OF ABUTTER ON PARK TO ENJOIN THE CONSTRUCTION OF A STREET RAILWAY THROUGH SAME.

Bayard vs. Bancroft, (Del. Ch.), 62 Atl. Rep. 6. Nov. 6, 1905.

It is well settled, the court of chancery of Delaware says, that a landowner abutting upon land dedicated in any way to the uses of a public park is entitled to invoke the intervention of a court of equity to prevent the diversion of the said land from the use to which it was dedicated; but the sole ground upon which is based his standing in court, the claim which entitles him to ask for relief, is uniformly held to be that he will receive some special damage from the total or partial destruction of such public use that differs in kind from that received by the public at large, by any individual as citizen and taxpayer. It is not necessary, of course, that the damage should be great; but there must be some injury of the tangible, practical kind that courts recognize as damage. The court of chancery has never used the tremendous power of the injunction process to protect artistic sensibilities.

It was in evidence in this case that the projected railway, after passing down a certain road, curved along the outside of the park, just within its boundary line, at a distance of 657 ft. from the front of the complainant's house, the abutting property, at its nearest point of approach. And during this part of its course, as alleged in an affidavit, it was plainly in sight of the abutting property owned by the complainant, and the complainant could by standing upon his front doorstep plainly see a large portion of the said line of the railway which ran through the parcel of the park aforesaid. The affidavit then alleged the unsightliness of its poles and appurtenances and the marring of a grassy knoll of great beauty through which it passed. But the court holds that, however unsightly and unpleasant all this might be to the complainant, it did not constitute such an injury as could be construed by the court to be the special damages which must be proved by him to entitle him to the relief which he sought.

NOT REQUIRED TO GIVE TRANSFERS WHERE LINES DO NOT INTERSECT.

Ketcham vs. New York City Railway Co. (N. Y. Sup.), 95 N. Y. Supp. 553. Oct. 27, 1905.

This action was brought to recover a penalty under section 104 of the New York railroad law for failure to give through transportation at a point where the company's line on one street approached its line on an intersecting street, but where there was an intervening space of about 30 ft. between the nearest rails of the respective lines of railroad. In holding that the claim to the penalty, upon the facts presented, was not within the purview of the statute, the appellate term of the supreme court of New York says that, in its opinion, the reasonable meaning of this statute is such as to restrict its operation to lines of railroads substantially intersecting, and to exclude a case where a passenger has been carried to the known terminus of one line. The words "continuous trip," as used in this statute, are not satisfied by the mere physical proximity of two lines of railroad, with the attendant ease with which a passenger might walk from one line to the other, where the railroads are physically distinct and are not operated as intersecting lines in one railroad system. If the plaintiff were entitled to a transfer at the point in question, it would be difficult to say that he was not equally so entitled at a point a block away, where, by reason of the divergence of the one street from the other, the distance between the lines was greater, but not too great, to be covered by a pedestrian with ease and dispatch; and, upon the same line of reasoning, the right of a passenger to transfer from one of two parallel street railways upon different streets, which were one or two blocks apart, would also, necessarily, be upheld. This result does not seem to have been within the contemplation of the legislature.

NOT REQUIRED TO PUT DOWN RAIL TO PREVENT PASSENGER BEING THROWN OUT AT CURVE—FAILURE TO EXERCISE HIGHEST CARE SLIGHT NEGLIGENCE —MEANING OF "GROSS NELGIGENCE."

Dolphin vs. Worcester Consolidated Street Railway Co. (Mass.), 75 N. E. Rep. 635. Oct. 19, 1905.

This action was to recover damages for a passenger being thrown out of an open electric car by its being driven around a curve at high rate of speed, while a wooden rail was up which ran along the outside of the stanchions supporting the roof of the car, and which was lowered to prevent passengers getting off or raised to allow them to do so. It was argued that the injury would not have happened if the railing had been down. That, the supreme judicial court of Massachusetts says, might be conceded. But that was not the question. The question was whether it was negligence on the part of the corporation to have failed to adopt a rule requiring the rail on that side of the car, which was on the outer side of the curve, to be put down, when one of its cars was going around curves like the one in question. The corporation had provided by rule for a speed not exceeding three miles an hour on

sharp curves. It was manifest that the rails in question were intended to prevent passengers from leaving a car on the inner side, where there were double tracks. In the court's opinion there was no such probability of a passenger's being thrown bodily out of his seat while the car was going around a curve as to require the corporation, in the exercise of the highest degree of care, to adopt a rule which should insure his being held in his seat by physical force.

The trial judge, the court holds, was right in refusing to give a ruling that when the duty of exercising the highest degree of care is incumbent upon the defendant, any failure upon the part of its servants to exercise that degree of care is gross negligence. A failure to exercise the highest degree of care, the court says, is slight negligence.

The term "gross negligence," in a case where the degree of care due is the highest degree of care, means that there has been a gross failure to exercise that degree of care.

RIGHT OF LESSEE OF PARK TO ADMIT STREET RAILWAY—POWER OF LESSOR UNDER RESERVATION TO GRANT RIGHT OF WAY—REQUIREMENTS AS TO LOCATION—WHAT EMBRACED IN TERM "STREET RAILWAY"—MAY HAVE TERMINUS IN TOWN NEVER PLATTED.

Montgomery Amusement Co. vs. Montgomery Traction Co. (U. S. C. C., Ala.), 139 Fed. Rep. 353. July 12. 1905.

The lessees of certain property for park purposes and a pleasure resort, the United States circuit court, in Alabama holds, had the right, so long as they exercised it without permanent injury to the freehold, to solicit and permit the entrance into the park of any vehicle which brought customers into it. They had the same right to admit a street car as they had to admit carriages. They had the same right to permit the construction of a roadbed into the park for a street railway as they had to make driveways for automobiles and vehicles drawn by horse power. The lessors could not have defeated the exercise of this right if they had objected, provided the power was exercised in such a manner as not to permanently injure the freehold. And the assent of the lessors to an entry of a street railway into the park, not made at their instance, and which they could not prevent, could not work a forfeiture of the right reserved by them, in a provision in the lease stating: "Nothing in this lease shall be so construed as to prevent the parties of the first part from granting a right of way by deed or lease, through any part of the leased lands for street railway purposes.

Furthermore, the court says that in Alabama, at least, the meaning of the phrase "street railway" gradually broadened until it included not only surface roads for passengers on streets and highways, but also what are known as "trolley lines," which reach out from cities to the adjoining country, and frequently run off the public road—a policy the public authorities now encourage—in order to reach points in the vicinity of cities and towns, though outside of their boundaries, and off the public highway, wherever passenger traffic encourages street railway service. And it holds that a street railway of this kind, which at the time this lease was entered into had one of its termini ending in a park it bought, outside of the city limits, and ended within about a mile of the leased premises, clearly, in view of the surrounding circumstances, was of the class of street railways, if not the very railway, which the parties contemplated might enter the park when the power was reserved to grant rights of way for "street railway purposes."

Another thing, the place had been incorporated as a town, and the court says that whatever the anomaly of a town which has never been platted, and is wholly without streets, and whose entire territorial limits have, by the act of the proprietors of the soil, been surrendered to the possession of a private corporation engaged in a wholly private business, the fact remained in law, that the territory was in a town, and it was therefore one of the places which under the law might be a terminus of a street railway, and the traction company had capacity to hold a right of way there.

The power to locate the right of way under the reservation in the lease must take the channels of least injury to both parties at the same time it was sought to exercise the power. So long as the leased lands were not actually so used that a location for a street railway would require the amusement company (lessee) to remove its buildings and structures, or disarrange them and the adjacent ground, or deprive it of proper control and economical management of the lands occupied for a park and place of amusement, the amusement company had no right to object to the location of a right of way through any part of the leased lands.

GRANT OF FRANCHISE TO INDIVIDUALS VOID—NO ASSIGNMENT VALID— NEW CONSENTS NECESSARY FOR NEW ORDINANCE—STREET RAILWAY NOT AN ADDITIONAL SERVITUDE—ROAD AUTHORIZED TO CARRY MAIL, EXPRESS MATTER AND MILK A COMMERCIAL RAILROAD AND ADDITIONAL SERVITUDE —COMMERCIAL RAILROAD DEFINED.

Wilder vs. Aurora, De Kalb & Rockford Electric Traction Co. (Ill.), 75 N. E. Rep. 194. June 23, 1905.

Where the right to lay down, maintain, and operate a railway on a certain street was granted by a city ordinance to four individuals, and not to any incorporated company, the supreme court of Illinois holds that, under the state statutes, the grant was absolutely void. And as that ordinance was absolutely void because of the grant to individuals instead of a company, it holds that there could be no valid assignment of it. Moreover, the ordinance being invalid in attempting to confer rights on the four individuals, could not be valid because it authorized such individuals to assign the franchise or privileges conferred upon them. This, the court says, would amount to a delegation of power by the city council to the four individuals to license a railroad company to construct and operate a railroad in a street of the city. An ordinance attempting to so delegate power is void. Legislative power conferred upon municipalities cannot be delegated.

Nor could the consent or petition signed by the property owners used as a basis for the action of the city council in passing that ordinance be used as the basis for a subsequent ordinance conferring upon a company the same rights as were conferred upon the four individuals. In order to invest the common council with power to pass the latter ordinance, there should have been a new petition by the requisite number of property owners. Another thing, the court is not sure that the property owners who petitioned for a grant to individuals for 40 years would have been satisfied with a grant (some two years later) to a corporation for 38 years.

If the road to be constructed be regarded as merely a street railroad, the court says that it could not be regarded as an additional servitude, and the complainant was not entitled to an injunction against its construction, even though he was the owner of the abutting property and of the fee of the street in front thereof to the center of the same. On the other hand, if it was a commercial railroad, he was entitled to compensation before it could be built over that part of the street opposite his lot, which he owned in fee subject to the easement of the public. Now, the road to be constructed was authorized to carry not only passengers and their ordinary baggage, and United States mail and express matter, but also milk. Again, the ordinance authorized the company to do such excavating and grading as it might deem necessary for the proper laying of its tracks, thereby failing to confine the laying of its tracks to the surface of the street. It also authorized the company to connect its tracks with the tracks of any railway company owning or operating tracks in the city for the purpose of forming a loop, and authorized the use of its tracks in connection with its interurban tracks, when laid. In the court's opinion the railroad to be constructed was what is called a "commercial railroad," and was not a street railroad within the definite and fixed meaning of the latter term. Being a commercial railroad, it constituted a new and additional servitude upon the fee of the property owner to the center of the street. Therefore, inasmuch as the complainant was the owner of a lot abutting on the street, was an owner of the fee of the street in front of his lot to the center thereof, and inasmuch as the defendant was about to construct a new and additional servitude in the street upon his property without having paid him any compensation or instituted any condemnation proceeding, he was entitled to an injunction.

A railroad authorized to carry freight as well as passengers, the court says, becomes a commercial railroad, instead of a street railroad. The fact that the road is limited to the carriage of one kind of freight does not make it any the less a commercial railroad.

Piping and Power Station Systems.—XIV.*

BY WILLIAM L. MORRIS, M. E.

The branch from which live steam is drawn to clean the accumulation from storage oil tanks is seldom used and therefore should have a stop valve as close to the steam main as possible. Steam is used to raise the temperature of the tank cleaning water, so that the grease and precipitation can be removed from the sides

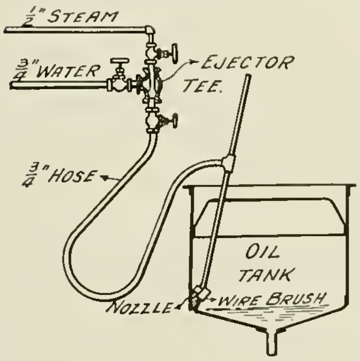


FIG. 111—(A13-1).

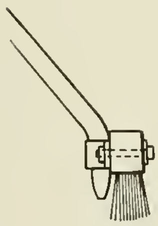


FIG. 112—(A13-2).

and bottom and easily washed out of the tank. The simple method of piping for the tank supply is shown in Fig. 111—A(13-1). The hose is connected to a valve next to the ejector tee which operates as a mixer. The cleaner is made of a length of pipe with a wire brush attached at the lower end and a nozzle from the pipe adjusted to discharge the steam and water on the brush. This device offers a quick method for loosening and washing the gum and grease from the shells of oil tanks. The hose need not be wire-wrapped because it is not under very high pressure, possibly 15 or 20 lb. The brush can be secured to the bent pipe as shown in Fig. 112—(A13-2). The upper portion of the handle should be of pipe with its lower end forged solid.

It is not customary to install a steam blow-off from a header to the atmosphere. For this reason it often is necessary to reduce the pressure on the header by blowing off through some engine. If the header is divided into three sections, each section should have a blow-off not less than 1½ in. in diameter run through the roof. Repairs to the steam main can be made much more readily if there is a means of quickly relieving the pressure on a damaged section.

The steam line which feeds a damper regulator is ordinarily designed to transmit the pressure in the main to the weighing device of the regulator. This line should be tapped from a drip pocket or the bottom of the header, so that condensed water will be delivered to the regulator pipe instead of steam. If the valve at the regulator were leaking badly at a stuffing box, the small pipe would then not be able to condense fast enough to supply water to the leak. This would allow live steam to come in contact with and injure the rubber diaphragm. Such damper regulator diaphragms are made to stand the boiler pressure, but they will not stand the temperature of steam at boiler pressure.

Steam is often fed to a filter so that more rapid work can be done by a filter which is of too small capacity. It is often found that oil is very stiff when cool and requires heating in order to enable it to pass through the filter. The oil when in this condition is "too fat," and has been made so by the addition of considerable cylinder oil returning with the drips. The correct remedy for such a condition is to remove the excess fats by allowing the oil to stand, when the impurities will precipitate. If the filtering arrangement is amply large, and the oil is in good condition, better results are obtained by keeping the oil as cool as it can be freely handled in the pipe lines. The better method is to place the filter in a warm place and not use a steam heater in the filter. The room where the filter is to be placed should have a temperature of 70° F., and the filter bed should be of ample dimensions for oil to pass through without forcing. A simple heater, as used for filters, is as shown in Fig. 113—(A16-1). This view shows valves at both the inlet and the outlet, but it is somewhat safer to use a valve as a throttle at the inlet side only, leaving the other end free to drip into the sewer. The coil when placed is pitched slightly downward, having the outlet about 2° lower than the inlet. Such a coil can readily be removed and is well supported.

A steam branch is led to the oil drip main for the purpose of cleaning it and can be arranged as shown in Fig. 114—(A17-1). The steam line should connect with the drip main through a syphon tee with a water connection below. The steam and the water should each be controlled by separate valves with the syphon tee located somewhat higher than the drip main. The main should have two discharge valves, one to a filter and one to the outside of the building. Each engine branch should connect with the

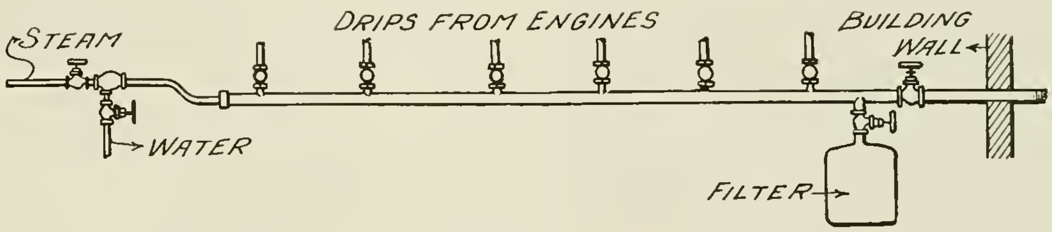


FIG. 114—(A17-1).

drip main through a valve. The drip, steam and water branches should be sufficiently elastic to allow for free expansion and contraction of the drip main. The end projecting beyond the building should be threaded so that the line can be extended when it is to be blown out. The drip line should be made of ¾-in. pipe and

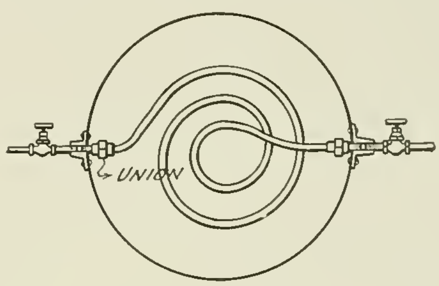


FIG. 113—(A16-1).

should blow to the atmosphere so that the steam may escape and thus avoid blowing the grease and gum into the drainage system. Blowing the drip main to the atmosphere also furnishes a means for observing the condition of the wash water.

WATER COLUMNS AND STEAM GAGES.

The steam and water connections to water columns will be taken as one subject. It is essential that water column connections

for both steam and water be provided with means for easily cleaning and inspecting. The steam connection to the column should be well drained, either to the boiler or to the column. If valves are used in the connections they should show, in an unmistakable way, whether they are open or shut.

The steam connection to a water column is often made with bends and elbows thus providing no facilities for inspection. Even though the steam connection is not liable to scale or become blocked, it is certainly safer and more in line with good operating practice to be able to know positively that the steam branch is clear. The connection shown in Fig. 115—(A18-1) has the steam and water connections made with cross and plugs. The plugs should be long threaded and made of solid brass. The column shown is faced for flanged connections and for attaching a supporting bracket. The column manufacturer will

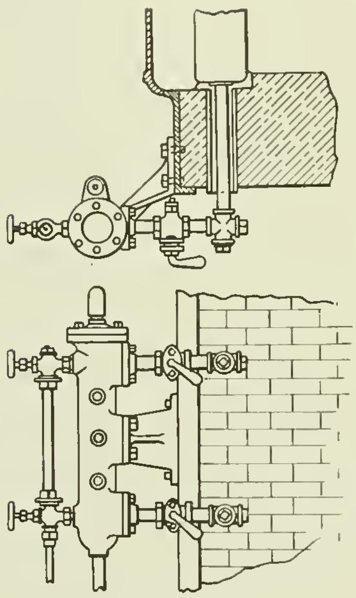


FIG. 115—(A18-1).

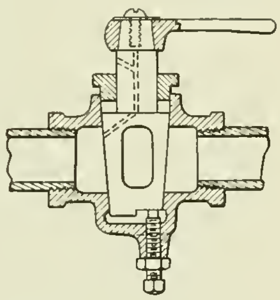


FIG. 116—(A18-2).

furnish the water column faced for flanges and provided with a bracket suitable for attaching to the boiler front. For high pressure work a flanged connection is the only satisfactory way of attaching the water column. By supporting each column free from the pipe work a better line is kept, the piping is more secure and pipe can be disconnected without disturbing the columns or their connections.

Such connection pipes as pass through the boiler settings should be protected by pipe sleeves two sizes larger than the connection pipes. Pipe 1¼ in. in diameter is generally used for connecting water columns, the duty being practically the same for any size boiler. If the connections are more than three feet in total length, the column should be separately supported, and if separately supported the individual connections should not be much shorter than three feet. This will provide for the differences in expansion of the boiler frame, front and connections. In some localities the use of valves between a water column and its boiler is prohibited. Such practice should be prohibited in all cases unless valves are used which will give an unmistakable warning if they are closed.

Fig. 116—(A18-2) shows an ordinary, outside-packed plug cock, with stop screw and small port hole through the plug so arranged that steam will blow to the atmosphere during the time that the column is shut off from the boiler. The amount of steam that this cock would blow through its port hole in case it were closed would be sufficient to give warning, and at the same time not interfere with changing a gage glass, gage cock or such part as might be out of order. A valve of this type will also show by the position of its hand lever whether it is open or shut. If a gate valve is used it should be of the rising-stem type, so that it will show from the outside whether or not it is open. The inside-screw gate type such as is commonly used for high pressure work should not be considered in planning for water column connections. The ordinary types of globe and angle valves are not suitable for water column work because of the difficulty of cleaning them.

As shown in Fig. 117—(A18-3), an extra heavy cross valve can be used and serve the purpose as well as any of the usual methods. The side plug and the centre of the valve may be removed when cleaning the pipe branches to the water column. Due to the fact that the stem in a cross valve has such a long travel, it is easily seen by the position of the hand wheel whether or not the valve is open. The valve bonnets should be square instead of hexagonal to facilitate removing them from the valve body.

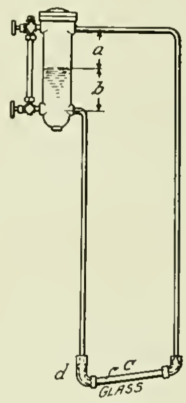
If the boiler fronts are quite high, the level of the water in the column may conveniently be indicated by a low down mercury gage, similar to that shown in Fig. 118—(A18-4).

In calculating the proportions for this extension device let the distance a-b be 13½ in., when there will be ½ lb. pressure at the lower end of the column. A column of mercury about one inch high would balance this pressure. If the distance, a, from the top of the water in the column to the upper outlet is one-half the height of the column, 6¾ in., the difference in pressure at the bottom of the two long pipes will be ¼ lb. and as the water stands at half the height of the column the mercury should also stand at the midpoint of the glass "c." The proportions are arranged so that when the mercury has just left the glass, there will be a column at d, one inch high balancing the water column a-b. If c has ¾ in. incline in its length, then ¼ in. lengthwise of tube d should have the same contents as the entire tube c. The water columns below b are balanced and their length does not vary the effect on the tubes c and d. This gage can be placed four or five feet above the floor line and will be in plain view of the operator, the mercury vibrating in the glass in the same manner as water would in a water glass.

Another method of showing the water level conspicuously is by the use of a lamp in an enclosed metal casing placed as shown Fig. 119—(A18-5), the casing having a slit in line with the glass. With this arrangement the water is well illuminated and the lamp is out of sight thus doing away with the blinding effect of a naked lamp alongside of the gage glass. The enclosing case ordinarily is made of heavy tin with the outside painted and the inside left bright to serve as a reflector. The top of the case should be left open for ventilation and cleaning. This device can be made by any tinsmith, the water gage being standard with a close nipple. A coupling is attached between the glass and the column to set the glass away from the column a sufficient distance to accommodate the lamp in its case.

Much thought and study has been given toward developing a device that will close the valves of a water column when the gage glass breaks. The principal feature of nearly all these devices is a check that falls away from its seat when the valve is closed but is free to reach the seat when the valve is open. This detail is shown in Fig. 120—(A18-6).

The difficulty with this check for the gage is occasioned by the ball shutting off the gage glass after blowing out through the blow off lettered "a" in Fig. 119—(A18-5). The trouble necessary in closing and opening such a valve and dropping the ball off the seat is a strong argument in deciding against their use.



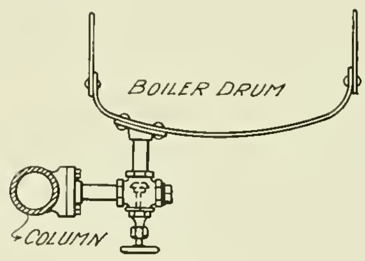


FIG. 117—(A18-3).

FIG. 118—(A18-4).

Another type of self-closing water gage is as shown in Fig. 121—(A18-7). This shut-off device is not operated by the steam flow through the valves and the glass may therefore be blown out as violently and often as desired without danger of closing the valves to the boiler. As the water glass is practically the only means used for ascertaining the amount of water in the boiler an operator should be free to blow it out as often as necessary to satisfy himself that the level of the boiler water is shown correctly in the column. The gage valves shown in Fig. 121 are of similar construction to the one shown in Fig. 120, but with the ball omitted. The valves have either a very coarse or a multiple thread on the stems and have levers attached to the stems instead of hand wheels.

The levers are connected together and stand in their upper position when the valves are open. A small wire, a, is run around the glass and attached to the end of the lever as shown. This wire supports the weight, b, which will close the valves should the gage glass break. The spring, c, is to relieve the valves of any serious strains when the stem closes on its seat. The valves on this gage can be closed at any time by detaching the wire from the hooked lever. The small wire does not offer any obstruction to the view, but should be of sufficient size to denote the desired water level which is to be maintained.

Water columns are often loaded with too many attachments such as automatic high and low alarm, boiler feed regulator, self gage-closing arrangement and operating chains, gage cocks with chains, column valves with chains, counter-weights, etc. Each of such devices has points of slight merit but there is a danger in using too many safety devices. To evade the use of too many attachments the column valves could be similar to that shown in Fig. 120, and be provided with a projecting pin at the end of the lever; water gages and gage cocks also could have similar pins arranged for operation as shown in Fig. 122—(A18-8 and 9). The rod with which the valves would be operated should have a long handle similar to a window stick. If the water column to be tended is 16 ft. above the floor, the rod should be about 12 ft. long. With a long rod the operator can keep out of the way of steam and water, and the use of automatic devices and hanging chains is done away with.

Much trouble is experienced in keeping gage cocks tight and many stations do not allow gage cocks to be operated except when there is no gage glass in the water column. It is good practice to use two water gages and no gage cocks, but if gage cocks are to be used they should be of such form that they can be made to close as tightly as any other valve and not depend on a small weight, spring or boiler pressure to keep them tight. No ordinary valve can be kept tight under such severe service.

Fig. 122 shows a gage cock that is operated by a pole as earlier described. A pressure sufficient to flatten out the valve seat is possible with this device. It is the general practice in boiler rooms to have the chief fireman of each shift, as soon as he comes on, open the gage cocks and blow out the columns and glasses on all the boilers. He may blow out the glasses again during his shift, but not the columns nor the gage cocks. Therefore this small amount that gage cocks and water gage valves are used does not justify having chains constantly dangling from the columns.

There are numerous makes of high and low water alarms on the market, the majority used being float operated. On high pressures, say above 140 lb., much difficulty is experienced with the collapsing of floats, and the screeching of whistles is also very objectionable. It is, however, good practice to give warnings with an alarm column. Such alarms can be given in high pressure plants

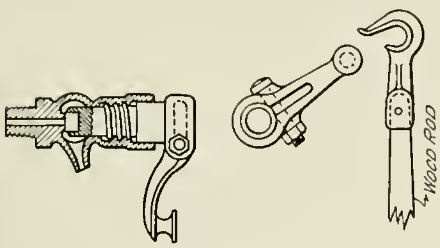


FIG. 122—(A18-8 AND 9).

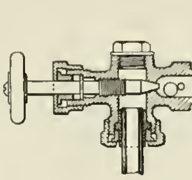


FIG. 120—(A18-6).

by the apparatus shown in Fig. 123—(A18-10), the essential parts of which include the high and low electric alarm column, using a light at each boiler, a bell alarm in the boiler room and a "buzzer" in the chief engineer's office.

One alarm bell will serve for the entire plant, and by having a signal lamp at each column, the particular boiler or boilers having high or low water will readily be observed. The float, a, is made of aluminum and counter-balanced with the weight, b. The porcelain insulator, c, has packing above and below where it is clamped to the column and also at the ends where the contactor, d, runs through the insulator. The pin in the counter-weight moves free of the contact segment, d, and so completes the circuit only at high and low water. The only friction that this device must overcome is at the pins, c and f, which are loosely fitted and made of brass. There are no dripping or leaking parts to this column, all being sealed and tight. An open, low-potential circuit would be used with a ground return, the contactors in columns serving to ground the circuit.

The column shown in Fig. 124—(A18-11) is the simplest form of float column now on the market. This device has one lever which opens a whistle valve for high or low water by pressing either upward or downward on the end of the valve stem. The rod, a, slides loosely through the large eye in the end of the lever. There are but few moving parts and as long as the float "floats,"

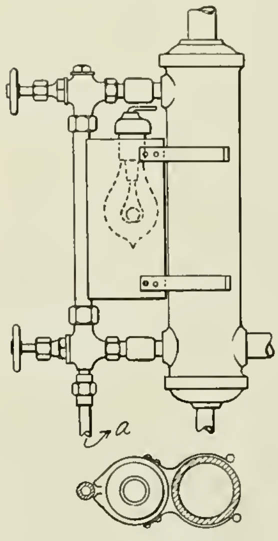


FIG. 119—(A18-5).

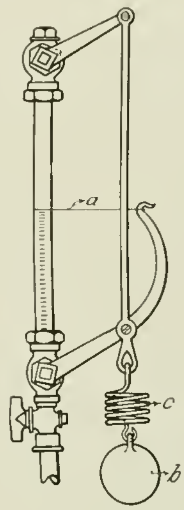


FIG. 121—(A18-7).

satisfactory operation and a loud noise can be expected from this device.

The connection to steam gages should be made so that there will be a sufficient length of pipe to offer condensing surface which will maintain water close to the gage and thus care for any ordinary leak at a cock, union or other joint near the gage. For this reason gages are often placed 12 ft. or more below the level of the steam line. This arrangement is proper but gages so placed should be designed to take into account the 12 ft. of water in the pipe, which would ordinarily add 5 lb. to the steam pressure. In other words, the pointer should either be set back 5 lb. or the dial should be graduated and marked while there is 5 lb. more pressure on the gage than readings would show.

In ordering gages, if a variation in readings is to be avoided, the condensation column should be given for each gage. In ordinary station construction this water pressure variation is often as high as 10 lb. and leads to confusion and misunderstanding of what the plant is doing. Apparently there may be a large line loss between header and throttle valve as shown by an indicator test, while in reality the difference in pressure is almost entirely traceable to the condensation column. The steam gage should give steam pressure only, not part steam and part water column. This error in gages is often overlooked, with the result that several pressures are indicated in a plant and the gages are often supposed to be wrong.

The ordinary type of cock furnished with the gage is often leaky and a cause of much annoyance.

The small needle valve shown in Fig. 125—(A19-1) has a union on the gage side. This permits the removal of the gage without disturbing the valve. The stuffing box with this type of needle valve can be made tight and kept so, which is difficult to do with the small plug cocks often used, and the needle valve may be had for a small additional cost.

Single-tube gages should be selected for power plant use as in such service a gage is quite free from excessive vibration. For locomotives where the vibration is severe a single-tube gage with its higher degree of sensitiveness is not available because of the injurious results of the vibration of a long single tube.

For such plants as are built purely on a commercial basis and

where expenditures are not to be made for decorative features, the iron back gages with a nickel-plated brass rim are found quite satisfactory. Marble gage boards are now out of date, originally having been furnished for engine installations in mills and factories where the one engineer would spend his spare moments polishing the brass and bright work. In large modern station work there are no "spare moments" and what was once polished is now merely wiped. Much of the work that was formerly polished is now left rough and painted. The tendency now is to get away from such decorative features. Light colored marble will show both rust marks and oil, and to keep such a gage board clean requires time and attention. For all practical and artistic purposes the painted plate iron gage board has many advantages. The gages may be easily attached to an iron board, heat and water will not damage it, and if it should accidentally be damaged the iron gage board can be straightened and put back in order. If its surface becomes badly marked, an iron board can be repainted by station help. There is but little chance to improve the appearance of an old or damaged marble board.

Such a steel board is shown in Fig. 126—(A19-2). There should be a slit in the floor back of the board through which the pipes could pass and back of some or all the gages should be a 6-in. hole in the plate to facilitate making the piping connections. The tools can be supported by clips attached to the plate by small machine screws. The board should have about 6 in. of space behind it and should be made of about 3-16-in. plate with corner angles of 2 x 2-in. angle iron. The shelf should be about 3 ft. high and 10 in. wide, with the angle iron projecting above the shelf. In the shelf should be a 2-in. hole through which dirt could be brushed. Round head rivets with the heads perfect on the outside should be used. The board could be painted and varnished in harmony with the nearby engines. It would also be a good plan to make the top removable for inspection or repairs and to enable a light being dropped inside.

The gage board can be illuminated in three different ways: By illuminated dial gages, by lamp brackets attached to the gage board,

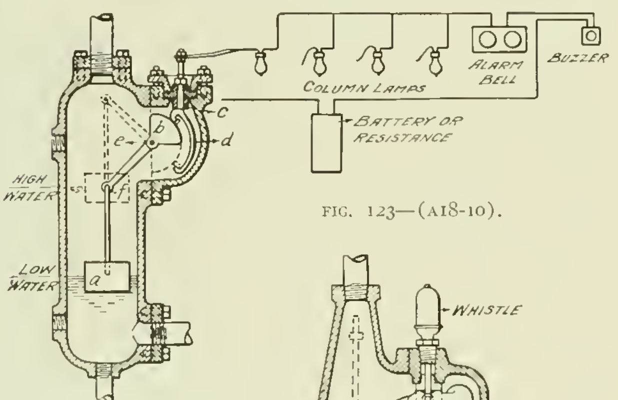
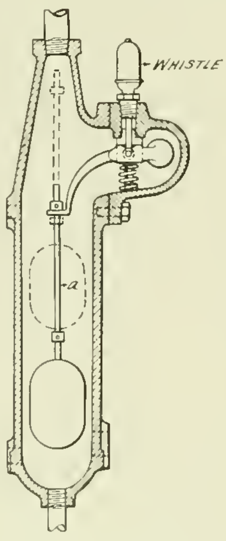


FIG. 123—(A18-10).



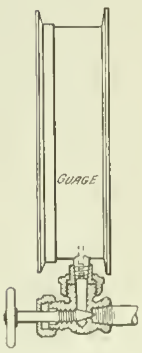
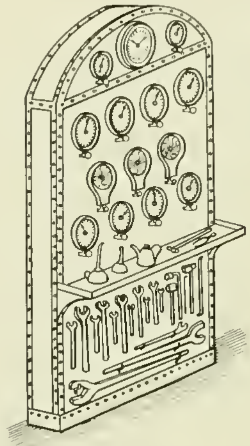


FIG. 125—(A19-1). FIG. 124—(A18-11).

or by a small head-light set back from the board and directed toward the gages. The illuminated dial gage brings into the design many details such as light wires behind the board; a lamp, switch, etc., for each gage; and a much more delicate and expensive type of gage. It is difficult to place lamp brackets so as to properly illuminate the board and not obstruct the view of the gages. The use of a single small headlight is by far the simplest arrangement to construct, operate and maintain, and the illumination will be found to be better than can be secured with side lights and quite as good as with the illuminated dial gages. If the gage board is placed between the high and low pressure cylinders of one of the en-



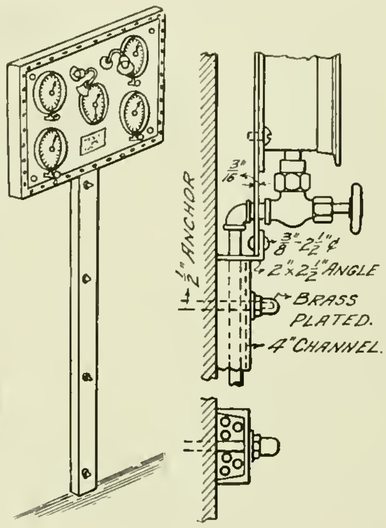


FIG. 126—(A19-2). FIG. 127—(A19-3).

gines, then the small headlight can be mounted on a generator, sufficiently high so that its light will not cast the shadow of the operator on the board in front of him. The boiler steam gages should be placed as low as possible and care should be taken that they are graduated for the known column of condensation.

In Fig. 127—(A19-3) is shown a steel gage board placed above the floor with a cover channel over the pipes and wire conduit leading to it. The anchors for holding the board to the wall should be of ½-in. wrought iron with polished or nickel-plated nuts. The rims of the gages and possibly the name plate and valves would look well if nickel plated. The lamp brackets and rosettes should also be plated. The board, channel and cases of the gages should be painted and varnished the same as nearby machinery. The exposed rivet heads should be carefully preserved while heading the rivets at the back of the gage board. Such a gage board as this can be made at small cost and will be found very serviceable and attractive, in fact even more attractive than the nearby stairways, trusses, building columns and structural work. When erecting the station the structural steel contractor could be asked to furnish the board and channel, and the steam fitter could erect the board and connect the piping. The painting should be done by the same contractor who paints the machinery.

Waverly Park.

LANSING & SUBURBAN TRACTION CO.

The Lansing & Suburban Traction Co. operates Waverly Park, which is situated on the shore of the Grand River, about two and a half miles from the city of Lansing, Mich. The park comprises about 25 acres, which have been improved and artistically laid out.

The usual amusement features are included and there are also a large hotel, a dance hall and an open-air theater with a seating capacity of about 1,200. About 50 steel row-boats have been placed on the Grand River and 25 donkeys have been purchased for the benefit of the children. Vaudeville is presented in the theater entirely and has been found to be the most popular form of amusement. A good band stand has been built and band concerts are given every Sunday afternoon.

The company also operates a park of about two acres at Pine Lake, which is located about eight miles from Lansing. This park has a casino 60 x 100 ft. in size with large, roomy verandas, a cafe and other features. The company has at this park about 50 new steel row-boats and an electric launch.

The Illinois Traction System.

Being a Description of the Recent Improvements and Extensions.

A little more than a year ago there were presented in this magazine two articles descriptive of the McKinley Syndicate properties of central Illinois. There were described at that time the street railway systems in the several cities and the interurban lines connecting them, all controlled by the "McKinley Syndicate." When the descriptions were presented the interurban lines included the system serving Champaign, Urbana, Danville and Georgetown and the line then just completed from Decatur through Springfield to Carlinville, 40 miles south of Springfield toward St. Louis. The large power-house at Riverton, near Springfield, was illustrated and described in detail as were its sub-stations and distribution circuits.

During the past year the McKinley syndicate has acquired several city systems in central Illinois and has extended its interurban mileage from Carlinville 60 miles to Granite City on the Mississippi River opposite St. Louis, also a 24-mile spur from Staunton to Hillsboro. An interurban line has been built north from Decatur to Bloomington. The uncompleted roadbed of the Springfield & Northeastern Ry. has been purchased and early in the year cars will be operating over this line from Springfield to Bloomington. The lines now operating include 110 miles of city track and 236 miles of interurban track extending from Danville near the Indiana state line to East St. Louis and Granite City on the Mississippi River, with the exception of the distance between Champaign and Decatur, where rights of way are being purchased for the connecting link. It is the purpose of this article to describe in detail the extensions and improvements that have been made during the past year and also to outline the operating methods used in handling the passenger and freight traffic of this extensive system.

The accompanying map has indicated upon it the operative and proposed interurban roads controlled by the McKinley syndicate, which also owns and operates a large number of gas, street railway and electric lighting properties in the cities near and on its interurban lines. The companies controlled by the McKinley Syndicate are as follows: Danville Street Railway & Light Co., Danville, Urbana & Champaign Railway Co., Urbana & Champaign Railway, Gas & Electric Co., Decatur Railway & Light Co., Illinois Central Traction Co., St. Louis & Springfield Railway Co., Urbana Light, Heat & Power Co., Jacksonville Railway Co., Consumers' Light & Heat Co., Jacksonville Gas Light & Coke Co., St. Louis & Northeastern Railway Co., Chicago, Bloomington & Decatur Railway Co., Peoria, Bloomington & Champaign Traction Co., Springfield & Northeastern Ry., Central Railway Co., Peoria; and the Peoria, Bloomington & Normal Railway & Electric Co. The latter three companies are recent purchases, having been acquired during the past month.

Recently Built Lines.

That portion of the Chicago, Bloomington & Decatur Ry., between Bloomington and Decatur, is now about completed, and cars were recently put in service on regular schedule from Decatur north to Clinton, a distance of 20 miles. The entire division is 42 miles long. It has a single-track roadbed built on a 60 to 100 ft. wide private right of way, with franchises for operating through the streets of the towns served. The roadbed conforms to the same standards as are used on the St. Louis division, being laid with 70-lb. steel and ballasted with gravel. Span-supported overhead work is used throughout the entire line.

During the construction of this division the Illinois Central R. R., whose right of way is paralleled by the electric line, put into operation a schedule of interurban steam trains, making stops at all highways as is customary on most electric roads. It is interesting to note that as soon as the electric cars began running, the traffic shifted from the steam to the electrically-operated road, and within a short time the unprofitable steam interurban service was abandoned. The electric cars now operate from Decatur to Clinton on a headway of two hours. It is expected in April to double the schedule and run the cars over the entire division from Bloomington to Decatur.

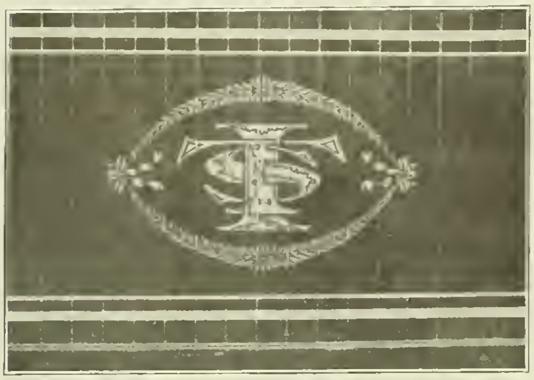
TRAIN OF SEMI-CONVERTIBLE CARS FOR THE ILLINOIS TRACTION SYSTEM.

With the opening of the line from Decatur north, an increased supply of direct current for the operation of the cars to Clinton became necessary. When the three lines now being built from Bloomington to Peoria, Springfield and to Decatur are completed, they will be operated by the single-phase alternating-current system, and as the opening of the portion of the Bloomington-Decatur branch was so far in advance of the construction work on the other two lines it was thought best to install a portable sub-station which could furnish the necessary direct-current for the use of the present standard type of cars until the single-phase equipment is received.

The portable sub-station, two interior views of which are shown, was recently equipped and is now in operation furnishing direct current at 600 volts pressure from temporary taps to the 33,000-volt transmission line. The apparatus consists of the company's stand-

ard sub-station electrical equipment including a 300-kw. rotary converter, three air-blast transformers and a marble panel board installed in an ordinary box car.

From Springfield to Granite City the right of way for the major portion of the distance is parallel with competing steam railroads.



ILLINOIS TRACTION SYSTEM MONOGRAM.

Throughout this line, which is 90 miles long, a high standard of roadbed construction has been maintained. The track is laid with 70-lb. rails in 33-ft. lengths. Forty miles of the track is supplied with Weber and 50 miles with Continuous joints. From Granite City north to Edwardsville the track is ballasted with chats.

Extensions in Progress.

The right of way has been purchased for the 40-mile line between Bloomington and Peoria. Plans are being completed so that the grading work may be started in the spring. A large bridge will be built across the Illinois River at Peoria, thus connecting the interurban proper with the recently acquired street railway system, the Central Railway Co., in Peoria. This division will be equipped for single-phase operation by a 3,300-volt trolley.

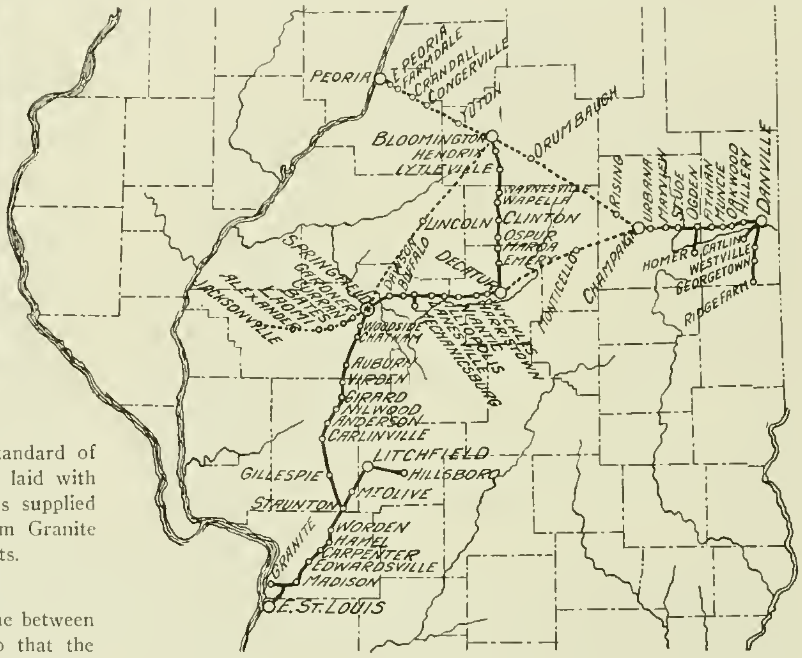
Since the first of the year the uncompleted property of the Springfield & Northeastern Ry. has been purchased. On this line, which will connect Bloomington with Springfield, the grading is about half done, and the bridges either placed or on the ground. The right of way from Springfield to Bloomington parallels the line of the Chicago & Alton Ry. for nearly the entire distance. It is expected that this link of the interurban system will be com-

INTERIOR OF PORTABLE SUB-STATION, ROTARY END.

pleted early in the coming summer. It will also be equipped for single-phase operation.

An engineering corps is now at work locating a route for the 42-mile line between Decatur and Champaign. The right of way purchases for the final route will be made at an early date, and construction work begun. The completion of this line will then make possible a service of limited cars from Danville to St. Louis, a distance of 220 miles.

There has recently been completed the Ridge Farm extension



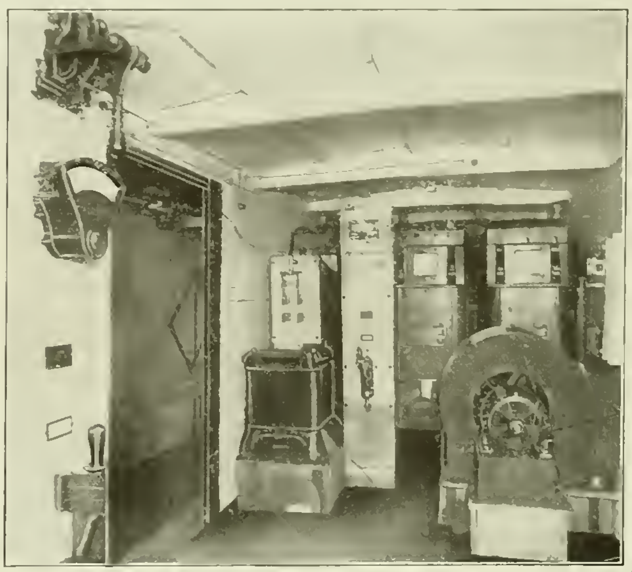
MAP OF ILLINOIS TRACTION SYSTEM, SHOWING OPERATING AND PROPOSED LINES.

of the Danville-Georgetown line, which serves the mining communities south of Danville for a distance of 18 miles.

During the past year the holdings of the Jacksonville Railway Co., with its electric lighting and gas properties were purchased, and plans have been made for a 33-mile interurban line connecting Jacksonville with Springfield.

Equipment.

During the past year several substantial orders have been placed, and new equipment for both interurban and city lines has been re-



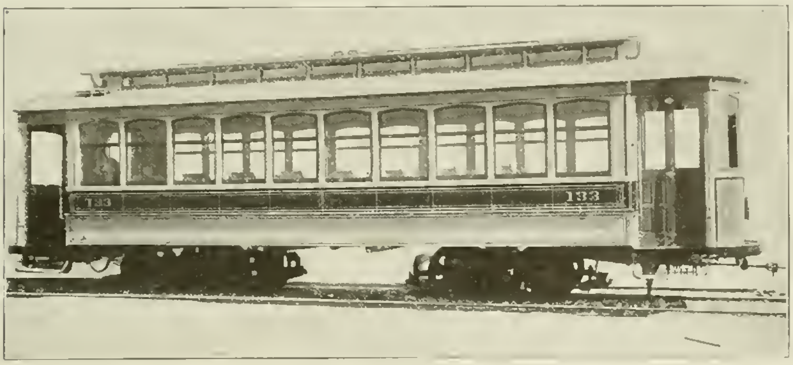
INTERIOR OF PORTABLE SUB-STATION, TRANSFORMER END.

ceived of which two types—the following described cars—are typical.

A number of the semi-convertible cars similar to the one shown in the illustration on the following page, have lately been fur-

furnished the Jacksonville Railway Co. by the American Car Co. The railway company operates 20 cars in the city of Jacksonville, and is a part of the Illinois Traction System.

The new cars measure 28 ft. over the end panels and 8 ft. 3½ in. over the posts at belt. Forty passengers may be comfortably seated, the seats being of spring cane. All the seats are transversely placed



SEMI-CONVERTIBLE CAR FOR JACKSONVILLE, ILL.

except four longitudinal seats at the corners. The seats are 36 in. long and the aisles are 23 in. wide. The advantages of the semi-convertible window arrangement in permitting as little or as much air as desired by raising the windows at different heights is too well known to warrant a full description. The low window sills, the height being 24⅝ in. from floor to top of sill, are considered to be a decided advantage in a car of this type. As the sills are too low to be reached comfortably by an adult person, neat arm rests are attached. The lower sash measures 26½ in. over the frame and the upper 17¼ in., and both together weigh 17 lb. As there are ten windows on a side, there is a 170-lb. weight of sashes when raised in each side roof, three quarters of which bears vertically on the tops of the posts. This excess of weight, though small, is amply compensated for in the extra strong construction, including a heavier letter board than usual. The interiors of the cars are finished in cherry with ceilings of birch. The trucks are of the Brill No. 27-G type and have a 4-ft. wheel base and 33-in. wheels.

The length over the crown pieces is 37 ft. 5 in., and from panel over crown piece, 4 ft. 8½ in. The width over sills, including panels, is 8 ft. 1 in., and over posts at belt, 8 ft. 3½ in., while the sweep of the posts is 1¾ in. and centers of posts are 2 ft. 8 in. The side sills are 4 x 7¾ in. and the end sills are 4¾ x 6¾ in. The sill plates are 12 x ⅜ in. and the thickness of corner posts, 3¾ in., and of side posts, 3¼ in. The height of steps is 14 in., and of risers, 17¾ in.

The train of six cars shown was recently received from the shops of the American Car Co., St. Louis, for use on the lines of the Illinois Traction System. These cars are of the semi-convertible, grooveless-post type, and are considered to be among the finest productions of this form of car. The interior illustration on the following page shows that the cars have a smoking compartment with seats for 16 passengers, and a passenger compartment with seats for 40. The cars are finished in golden oak, neatly inlaid, and the ceilings are tinted light green. At the platform end of the passenger compartment is a toilet room of standard steam car character with a hot water heater in the opposite corner.

The improved method of raising the sashes into the roof pockets does away with the grooves, or runways, in the posts and the trunnions on the sashes, which were formerly employed. The sash stiles are made of brass and there is a brass tongue-and-groove sliding connection between the two sashes so that the lower rides upon the upper; when the tops of both sashes are abreast, catches, which hold the upper sash in its lowered position, are automatically released and both sashes are conducted into the roof pockets by means of a pair of bow-shaped steel guides, which extend from the top plate to the lower ventilator rail, within the pocket. This is an exceedingly simple means of guiding the sashes into the pockets and a decided improvement over the former method, particularly as it does not require cutting grooves into the posts and reduces the width and depth of the roof pockets. The system as applied to interurban cars such as these adapts them to summer service by providing a means of clearing the window openings of the sashes and admitting as much air as is desired. Several window lock stops are provided so that the sashes may be held at any height permitted by the speed of the car or the temperature.

The window openings are 3 ft. 6½ in. high and the top of the window sills 24⅝ in. from the floor. Not having window pockets, the side lining is set in between the posts and the thickness of the side is but 2 in.; the ends of the seats are brought between the posts and against the side lining, which saves several inches to the aisle. To be specific, the outside width of the cars is 8 ft. 6 in. and the interior width 8 ft. 2 in., leaving the aisle 25 in. wide with 36½-in. seats. The seats are upholstered in spring cane and have step-over backs.

The general dimensions of the cars are as follows: Length over the end panels 39 ft. 8 in., and over crown pieces 49 ft. 8 in.; from panel over crown, 5 ft.; centers of posts, 2 ft. 8 in.; the side sills are 4¾ x 7¾ in. and the end sills are 4 x 6¾ in.; sill plates, 12 x ⅜ in.; thickness of corner post, 3¾ in., and of side post, 3¼ in. The cars are mounted on the American Car Co's. "M. C. B." trucks, type of truck No. 15, with wheel base of 6 ft. 2 in. and 33 in. diameter of wheels.

The rolling stock for the interurban lines includes the following equipment: Fifteen cars with 30 to 45-ft. bodies and four G E-57 motors, 3 cars with 30-ft. bodies and four G E-1000 motors, 4 cars with 40-ft. bodies and four G E-74 motors, 15 cars with 50-ft. bodies and four G E-73 motors, 3 cars with 60-ft. bodies and four G E-73 motors.

There has been adopted as a conventional sign for use on all cars the neat monogram shown in the accompanying illustration. As it appears on the side of a car in brightly-colored paints the design is especially pleasing. A button bearing this monogram is worn by many employes.

FORTY-TON FREIGHT LOCOMOTIVE.

Freight Equipment.

The extensive freight and express traffic which is carried on over the entire system is handled by the following equipment: 2 locomotives similar to the one illustrated; 2 motor cars for hauling various freight and work trains; 12 express-baggage cars equipped with four 65-h. p. motors, and air brakes; 60 gondola cars for handling coal;

12 center-dump freight cars; 4 Rodgers ballast cars; 12 side-dump coal cars, and 16 standard steam-road box cars of 60,000-lb. capacity for grain and hay traffic. There are also being built at Danville and St. Louis four more express cars which will be equipped with four motors each, type M control and air brakes.

The 40-ton locomotives were built in the Danville shops of the Illinois Traction System, and are used for handling the car-load traffic of coal, hay, grain and produce. One of these locomotives is kept on the eastern end of the line and one on the division between Decatur and Springfield. The motor equipment of each locomotive consists of four G. E. No. 73, 75-h. p. capacity motors geared to about 25 m. p. h. An additional locomotive, weighing 50 tons, is now contemplated in order to handle the rapidly increasing freight traffic.

FORM 108.

ILLINOIS TRACTION SYSTEM.

Notice to Agents:

Daily Report of Express Forwarded from .... 190 ...

This report must be made daily and forwarded to the General Office, the following morning on first car.

Date	W. B. No.	Consignee.	Destination.	Weight	Local Charges to collect	Advances	Prepaid	Blank

DAILY REPORT USED BY DISTRICT TRAFFIC AGENTS. (ORIGINAL $7\frac{1}{2}$ X 7 IN.)

Train Service.

The passenger traffic may best be described by outlining the service offered on each of the different interurban divisions:

Danville to Georgetown, 12 miles, 30-minute headway; Georgetown to Ridge Farm, six miles, 60-minute headway; Danville to Catlin, six miles, 60-minute headway. On these three operating divisions the schedules stated are maintained with five 48-ft. straight passenger cars.

Danville to Champaign, including a stub to Homer, making a total of $39\frac{1}{2}$ miles; 60-minute headway with every other train limited, local time 105 minutes, limited time 75 minutes. These schedules are maintained with five combination cars.

INTERIOR OF ILLINOIS TRACTION SYSTEM CAR.

Decatur to Clinton 20 miles, with cars every two hours. This schedule will be doubled in April, but is now maintained with two combination cars which make the run in 75 minutes.

Decatur to Springfield including a stub to Mechanicsburg, making a total of 43 miles, 60-minute headway with two limited trains each way per day; local time, 115 minutes; limited time, 85 minutes. This schedule is maintained with five combination cars.

Springfield to Staunton 60 miles; 60-minute headway, with limited cars making the run in 145 minutes, and local cars 180 minutes. Six combination cars are used for this service.

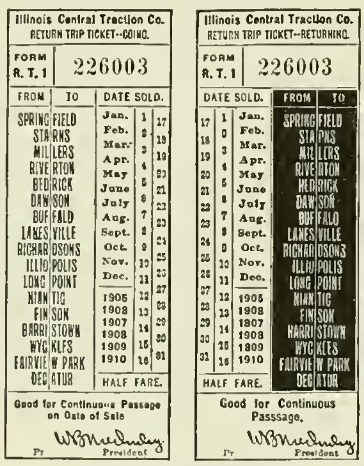
Staunton to Litchfield, 16 miles to which will be added an eight-mile extension to Hillsboro; 60-minutes headway, running time 50 minutes, requiring two combination cars.

Staunton to Granite City, the very recently completed extension of 30 miles, 120-minutes headway; schedule time 105 minutes, requiring three combination cars.

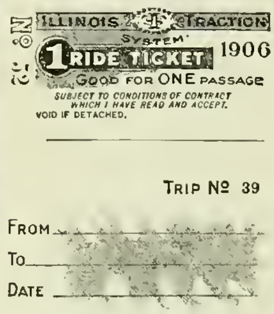
As the character of the track from Litchfield to Granite City, a distance of 55 miles, will permit of high speeds, it is proposed to increase the schedule at an early date and operate limited cars from Litchfield to the Mississippi River in 90 minutes running time and local cars in 120 minutes running time. Early in the summer there will be inaugurated a through limited service between Decatur and Granite City, a distance of 130 miles. Three 60-ft. three-compartment cars are being built for this limited run, which it is expected can be made in 3 hr. 30 min. Three limited trains will be operated each way per day. When the Decatur-Bloomington line is completed limited service will also be offered from Bloomington to St. Louis, over the connecting lines having a total length of 175 miles.

Ticket Forms.

The tariff sheets for the passenger traffic of all lines are offered to the public in the form of a printed folder. It is the policy to charge at the rate of two cents per mile for one-way tickets, and at the rate of one and one-half cents per mile for round-trip tickets. Ticket offices are maintained only at the terminals. Conductors are provided with round-trip tickets which are sold on the cars, thus giving the patrons between the terminals an opportunity for riding at a $1\frac{1}{2}$-cent rate, but no round-trip ticket is sold for less than 25 cents. The standard form of round-trip tickets is illustrated. Commutation books limited to 31 days are sold on a basis of one cent per mile, the standard book containing 52 rides. There is also a special book for school



STANDARD ROUND TRIP TICKET. SOLD AT TERMINALS AND BY CONDUCTORS.



EMPLOYE'S TICKET, SHOWING BOTH SIDES.

children containing 44 rides and a book representing $10 worth of transportation sold with a time limit for single individuals or families, or a stated number of members of a firm, the proper names appearing on the cover of the book. This book is sold for $7.50 net, and when bought by one person is good for a year. If purchased for a family or business firm it must be used by the several people in whose favor it is drawn within six month's time. The long strip in this book similar to a steam railroad mileage has indicated upon it lines representing cents in contrast with the customary method of representing miles. As the $10 worth of transportation is bought for $7.50, it is seen that in this way the holder of the book may ride between any two points on the line at the rate of 1½ cents per mile.

It is the policy to give the conductor something to ring up and turn into the office for every passenger carried. To maintain this policy for employes also, single-ride tickets similar to that illustrated are given on which the user indicates the stations between which he rides and signs his name.

tically the same as maintained by the competing express companies on steam railroads. The electric railroad companies, however, do not maintain horses and wagons at any points for delivery, but provide warehouses at terminals and small express rooms at all stations for the receipt and delivery of shipments.

Regular agents and assistants are maintained at important terminals. The agents at the smaller stations are usually interested in other business and paid a commission of 5 per cent on both outbound and inbound business. The management consists of a general traffic manager in charge of all the passenger and express traffic on all the interurban lines of the system. Directly under him are district traffic agents in immediate charge of the details of a particular district, consisting of one or more divisions of the system, and varying from 40 to 100 miles of road.

The district traffic agents have charge of the auditing of the express business of their divisions and remit semi-monthly to the auditors of the separate corporations to which their lines belong.

The express traffic is handled with a system of triplicate waybills,

Form 111

ILLINOIS TRACTION SYSTEM

EXPRESS DEPARTMENT.

STATION AGENT'S WEEKLY STATEMENT.

Statement for Week Ending ... ***at*** ... ***Station.***

DAILY COLLECTIONS				UNCOLLECTED LIST.			
DATE.	PREPAID FORWARDED.	RECEIVED COLLECT.	ADVANCES	DATE.	WAYBILL NO.	FROM WHOM DUE.	AMOUNT.
Miscellaneous Collections							
TOTAL							

BALANCE SHEET.

DR.		CR.	
Uncollected from last Statement		**Cash Remitted**	
Total Prepaid Forwarded for week		**Advanced to Connections**	
" Received Collect for Week		**Uncollected Per Above List**	
" Advances		**Miscellaneous Credits**	
Miscellaneous Collections			
Total		**Total**	

I HEREBY CERTIFY THAT THE ABOVE IS CORRECT.

(***Signed***) ... ***Agent.***

INSTRUCTIONS.—When you have freight on hand settlement day show the same as uncollected, taking credit for the same, and charge yourself on next final settlement sheet with amount for which you took credit on this. When you are notified by the General Office that a correction has been made on your report for any day your copy of daily report *must be corrected at once*, and totals as corrected, shown on above statement.

This statement must be made immediately after close of business on the 7th, 14th, 21st and last day of the month, and forwarded to General Office with daily report and remittance at once.

WEEKLY STATEMENT OF STATION AGENT. (ORIGINAL 8½ X 10½ IN. IN SIZE.)

No baggage is carried free, but is checked at stated rates for each division on which it is handled.

Express and Freight Traffic.

In the usual schedule of operation express cars leave the larger cities at 11 o'clock each morning, enabling the wholesale dealer to receive his morning mail, fill orders and deliver the shipments to the express terminals before the leaving time of the train, thus making the delivery of goods upon the same day that the order is received. The cars make a single round trip over their divisions, varying from 35 to 60 miles in length once each day.

The rates on express matter are based upon the Illinois Railroad & Warehouse Commission classification and mileage tariff, as is the general practice on all steam railroads in Illinois. The electric road endeavors to give its patrons steam railroad express service at standard freight rates.

The rates for handling express matter on passenger cars are prac-

the original sheet of one of which is illustrated. These bills are numbered consecutively and bound in blocks of convenient size. The blocks are given to the shippers in sufficient numbers to handle the business which they give the road. In this way the shipper makes out his own bill before bringing the goods to the warehouse which arrangement has several commendable features; no time is lost in making out waybills when a shipment arrives at the warehouse as it is only necessary for the agent to insert the proper rate and return the shipper his copy; the distribution of waybills for the use of the shippers advertises the traffic and relieves the railroad of maintaining one clerk at each important receiving station.

Each agent forwards to the district traffic agent a daily report of express shipments received and forwarded. This report has the form shown and is made with a carbon copy. Remittances are made from the agents to the district traffic agents on the 7th, 14th, 21st, and last day of each month. The items of these remittances are indicated on the weekly statement sheet as reproduced herewith, and

the accounts of the agents are balanced thus each week. The district traffic agents send in reports of the business of the day to the general traffic manager, the auditor and general manager, also keeping carbon copies for the station offices. Each of these reports is made with four carbon copies.

Carload Traffic.

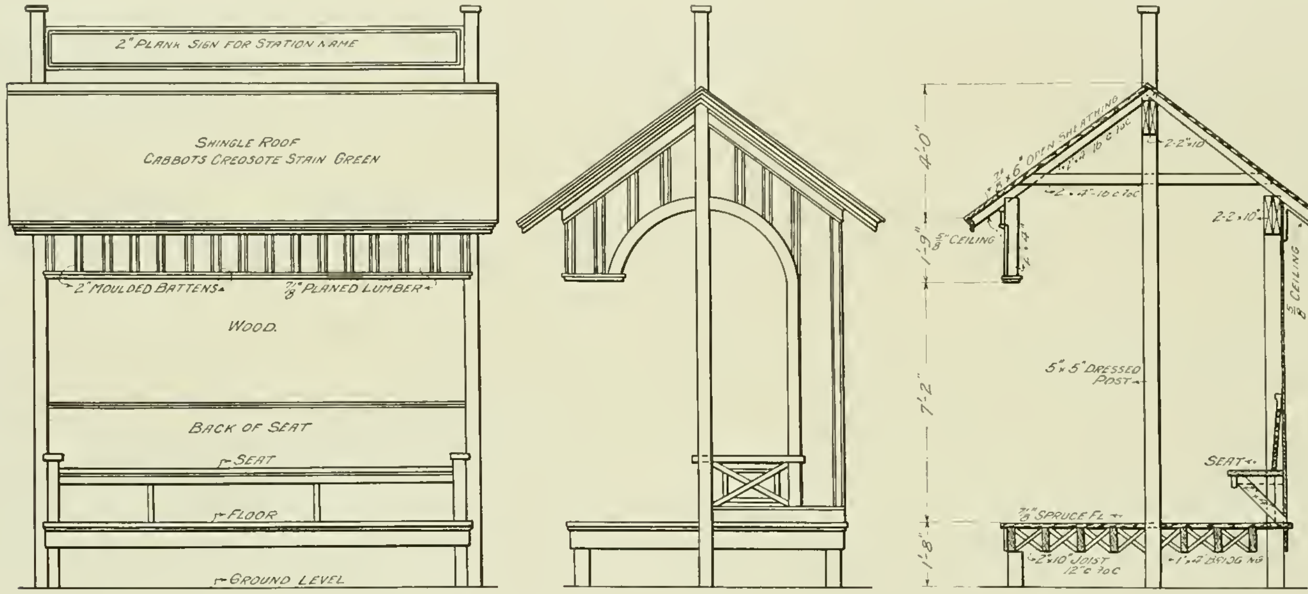
The 60 gondola cars of the system are used for coal traffic in the winter, being hauled by the locomotives earlier described.

The 60,000-lb. capacity box cars have M. C. B. draw bars and are of the usual steam railroad box car type, except that they have 18-in. side bearings and the brakes are hung on the truck bolsters to permit the cars to operate around sharp curves. In the winter these box cars are used for handling hay, grain and farm produce. In the summer a large number of cars is required for shipments of sand and gravel from extensive pits owned by the railway company to the cities along the line. This material is used for building purposes and for the construction of highways in the cities and country. Quite an extensive through car-load-lot traffic has been built up and shipments of grain and coal are made over connecting lines of the steam railroad systems. Foreign cars are taken on the electric tracks by suitable connecting switches, are unloaded at points on the electric lines, reloaded and again shipped out.

Dispatching System.

The cars on all the interurban lines run according to fixed schedules reporting at certain points. The operation of all cars and trains is in the hands of three dispatchers, located at Danville, Decatur and Staunton. If trains are off schedule, running orders are given to the crews by telephone and are copied in duplicate in small books of special order blanks made in a convenient size for the pocket.

By reason of the various classes of service operated, an automatic block signal system which would block out a limited train if a local or a freight train were on the line seemed undesirable. But to increase the certainty of operation and permit of flexibility when irregularities in schedules occur, an equipment of the controllable semaphores, known as Blake signals has been installed with 15 signals controlled from each of the three dispatchers' offices. With this equipment a dispatcher is able to reach his train crews at fixed points along the line, other than those stations at which agents are maintained, and it is not essential that crews call up the dispatcher at fixed meeting points, because by the dropping of a signal board the dispatcher can announce to the crews that a change in orders is necessary.



SIDE AND END ELEVATIONS AND SECTION OF STANDARD SHELTER SHED.

A DISPATCHER'S OFFICE WITH SIGNAL OPERATING DESK.

Station Buildings.

As the traffic from the various towns on the different divisions increases, stations and shelter platforms are built at suitable locations. These buildings in general conform to two designs, one of which is shown in the view at the station in Harristown. There are now five such stations between Springfield and Decatur, and 12 more will be built within the next few months on the new line between Springfield and Staunton. The buildings are 24 x 40 ft. in floor area and are set about 16 ft. from the track. Interior partitions divide the buildings into two rooms, one used for express and baggage and the other as a waiting room. Such way stations cost about $750.

WAITING ROOM AT SOLDIERS' HOME, DANVILLE.

At road crossings, where the traffic is not heavy enough to warrant erecting a station building, shelter sheds of the design shown in the accompanying line drawing have been erected. The floor of these sheds is 12 ft. long by 8 ft. broad.

The city system of Danville has at the terminus of one of its suburban lines a National Soldiers' Home, in which are quartered about 3,000 veterans. The tracks enter the grounds and make a loop about the waiting station which is illustrated herewith. This building is constructed of cut stone and brick walls with an ornamental tile roof having broad bracket-supported eaves.

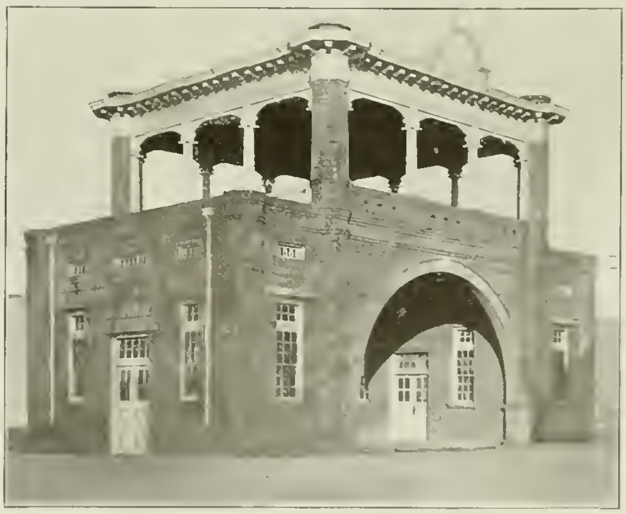
Another type of station may be seen in the illustration of the terminal of one of the branches of a Decatur city line which serves Decatur Park.

In the center of the city square in the business district of Decatur stands the terminal station and waiting room which is illustrated. This building is of pleasing design, including on the first floor a dispatcher's office and employes' room, and a general waiting room. The second story is open and used as a band stand. This building was erected at a cost of $3,600 subscribed by the business men of the city of Decatur whose property faces the public square. It was erected without any expenditure on the part of the railway company, and as all city routes and the interurban through cars pass this point, it is of much value from an operating standpoint.

At Georgetown on the branch south from Danville the company has built a terminal station which is even more imposing than the one in Decatur. As illustrated, this building is of substantial construction with heavy walls of paving brick. The design is such that the interurban cars pass directly through the center of the building offering at all times a dry platform for loading and unloading. Above the archway through which these cars pass is a covered space which may be used for band concerts or similar purposes.

TERMINAL STATION AT DECATUR PARK.

ARTISTIC STATION BUILDING AT HOMER.



TERMINAL STATION ERECTED AT GEORGETOWN BY THE RAILWAY CO.

Power and Distribution System.

Current for the electric lighting systems and for operating the city and interurban lines is generated at several stations which will be tied together with a system of three-phase feeders. There are power stations at Danville, Champaign, Decatur, Bloomington and Riverton, and plans are being made for building an 8,000-kw. generating station at Peoria.

The generating station at Riverton, which is a few miles east of Springfield, was described and illustrated in the "Street Railway Review," Dec. 20, 1904. Since this description was published there has been added the generating unit shown in the accompanying interior view of the power house. This is a Curtis turbine generating unit of 1,000-kw. capacity, and is served by the condensing equipment, a portion of which may be seen under the engine-room floor. The pressure-pumps and storage cylinder for the oil service of the

step-bearing, are located on the basement floor near the partition wall.

During the past year the boiler equipment has been increased by the addition of two 400-h. p. capacity Babcock & Wilcox boilers of the same type as earlier installed, except that the new boilers are equipped with chain grate stokers.

The three-phase alternating current generated at this station is distributed on a high tension line to seven rotary converter sub-stations between Decatur and the Mississippi River, a distance of about 120 miles. In each of these sub-stations is a 300-kw. capacity rotary converter supplying the direct current to the trolley wire and its supplementary feeders. The trolley wire is No. 000 copper. The high-tension line consists of three No. 2 hard-drawn copper wires.

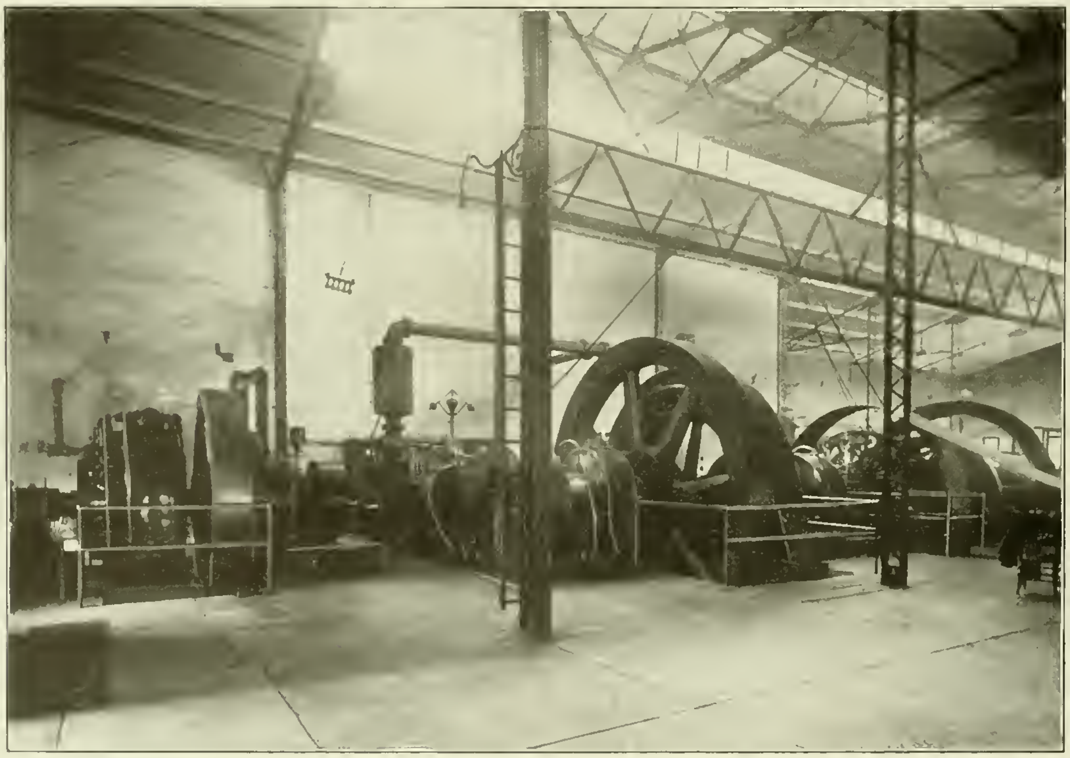
Danville Power Station.

The generating station at Danville which furnishes current for the several interurban lines, the local system, commercial lighting and power, and also steam for district heating service, is located within a few hundred feet of the public square in the center of the business district. The increased demand for the several kinds of current on this station has necessitated an increase in the capacity. The reconstruction work is now about completed and a description of the plant as it will be when in complete operation, may be interesting.

The south wall of the old building was torn down and a new wall built, thus increasing the floor area of the boiler house to an area of 150 x 85 ft. The building walls are of brick supporting a steel framework with a roof of reinforced concrete. The construction of this roof is unique. On the purlins which are supported by the roof trusses are jack rafters of an I section, spaced 6 ft. 8 in. center to center. These steel rafters support the concrete mass of the roof. The forms for molding the concrete were flat and placed between the webs of the jack rafters and against the underside of the upper flanges. When the forms had thus been placed the reinforcing was laid over the tops of the rafters. For this purpose there was used ordinary woven-wire fencing with a four-inch mesh. The strips were laid continuous from one end of the building to the other and given a lap of about six inches. Over this bed was then spread a layer of concrete four inches thick and well tamped against the heads of the jack rafters. The mixture used consisted of two parts of cement, two of cinders and three of gravel.

The two halves of the boiler house roof have been given different waterproof coatings and the results of each in service will be carefully watched. One portion is covered with five-ply tar paper protected by pitch and gravel. The half of the roof, with a southern exposure, has for its surface a finish coat of one part cement and two parts sand, laid one-half inch deep and trowel-finished. If cracks develop in this surface it is expected that they can be filled with tar and a waterproof roof thus obtained at a lower cost than usual when waterproof coverings are put on concrete cost than usual when waterproof coverings of several thicknesses of paper with their coats of tar and gravel are put on concrete roofs.

TRANSFER STATION AT DECATUR. A GIFT TO THE RAILWAY CO.



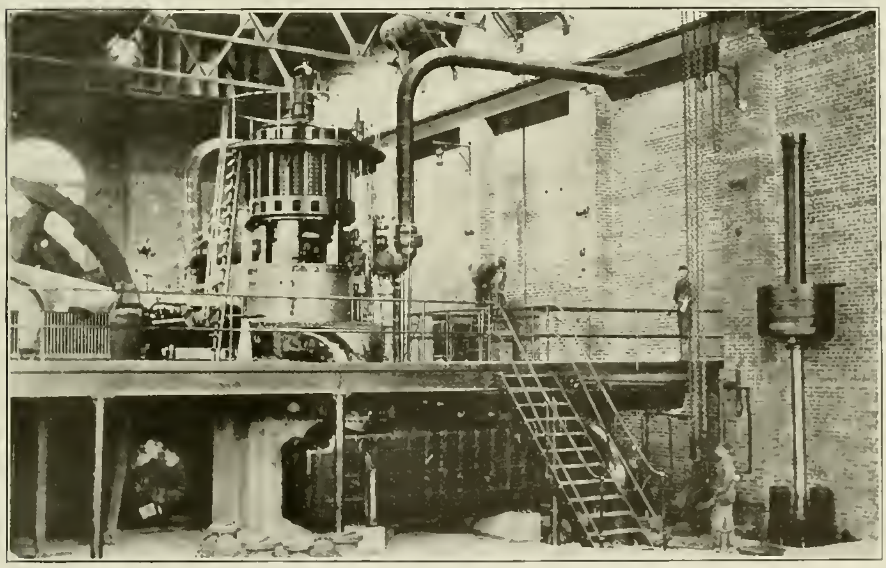
GENERAL VIEW OF INTERIOR OF THE DANVILLE POWER HOUSE OF THE ILLINOIS TRACTION SYSTEM.

The boiler house will contain eight batteries of water-tube boilers with a total capacity of 6,400 h. p. Each of the 16 boilers is fired by a Green traveling link grate. Coal is fed to the stoker hoppers by chutes from a series of steel overhead hoppers, comprising a bunker of 600 tons capacity. Coal is brought into the boiler house on a switch track and dumped from hopper-bottom cars into a crusher from the bottom of which a Mead overlapping bucket conveyor elevates and distributes it to the bunker. This same conveyor collects the ashes from the concrete pit beneath the grates and elevates them to a storage hopper over the switch track. The ash hopper has a concrete lining to protect the steel work from injury. The arrangement of the apparatus is such that when a car of coal has been emptied the same car may be refilled with ashes without any switching.

WAY STATION AT HARRISTOWN.

As there is an off-set in the fire wall between the boiler and engine rooms, the main steam header is half in one part of the building and half in the other, being anchored where it passes through the off-set wall. The header is 16 in. in diameter throughout the entire length of the building, and is fed with 12-in. branches each of which serves four boilers.

At each of four properly spaced points along the header where engine connections are taken off, a special detail of construction is used with a view to doing away with the use of separators between the main header and the engine leads. The connection between the pipe to the engine and the header at each of these four points is made with a large "cross," the steam for the engine being taken out of the top-arm of the cross. At the bottom of the cross is a 4-ft. length of 10-in. pipe which it is expected will act as a reservoir for collecting drips. These drips will be led from the bottom of the 4-ft. pipe to steam-trap connections, and then through the feed water heating system to the boilers.



NEW TURBINE UNIT AT RIVERTON POWER STATION.

The plans for the new condensing system include the use of the present tunnel from the boiler house to the nearby river bank, and the construction of a condenser equipment at the foot of the bank, which is about 75 ft. below the level of the boilers.

The engine and generating equipment in this station consists of a number of various types which have been added from year to year as the load has increased. The present equipment includes the following:

A 300-kw., 250-volt, direct-current generator direct-connected to an 18 and 24 x 32-in. Russell engine, close to which unit is a compensator for balancing the output which is distributed over a three-wire Edison commercial lighting system; an 800-kw. three-phase, 2,300-volt revolving-field type generator direct-driven by a 26 and 48 x 52-in. Hamilton-Corliss engine, the output of this unit is used for commercial lighting; a 300-kw., 550-volt railway generator direct-connected to a 28 x 48-in. Hamilton-Corliss engine; this engine also drives, by means of a belt, a rotary converter, which is operated as a double-current generator, its output being used either for supplying current to the high-tension railway feeders or to the direct-current network of the city and interurban systems; a 200-kw. railway generator driven by a 20 x 30-in. horizontal Buckeye engine; three Brush arc machines, two of 125 and one of 50-light capacity, belted to high-speed engines; a 300-kw. 2,300-volt, three-phase lighting generator, driven by a 26 x 36-in. horizontal Buckeye engine; two 55-kw., 125-volt, 4-pole direct-current generators, belted to a 15 x 14-in. high-speed engine; these small units are connected so that they may be used as the demand requires either on the two sides of the Edison three-wire lighting circuit, or in parallel on the exciter busses. The generators are of the General Electric Co's. make.

The exciting current is furnished by a motor-generator set consisting of a 125-volt, 360-ampere generator, driven by a 75-h. p., 2,300-volt induction motor.

The oil for the entire plant is filtered and distributed by a 300-gallon capacity, Turner gravity oiling system, with pumps and storage tanks in the basement.

There are four switchboards for controlling the output of the various generating units. Each board is located near the generators which it serves.

Personnel.

The officers in charge of the various properties are; for the Illinois Traction Co.: William B. McKinley, president; L. E. Fischer, vice-president and general manager; W. J. Ferris, assistant manager and purchasing agent; G. B. Macaulay, secretary; G. M. Mattis, assistant treasurer; B. R. Stephens, general traffic manager; H. C. Hoagland, electrical and mechanical engineer; J. G. Chester, assistant electrical and mechanical engineer; B. E. Bramble, general auditor; and for the other properties John Finley, general manager Central Railway Co., Peoria; and the following general superintendents: M. G. Linn, Bloomington; M. L. Harry, Decatur; J. E. Johnson, Danville; H. J. Pepper, Champaign; John Glover, Urbana; L. O. Williams, Staunton; J. P. Doan, Jacksonville.

Request for information regarding Benefit Associations.

The Bureau of Labor is preparing a report covering the various systems of workingmen's insurance and employers' liability both in this country and abroad. In this connection it is endeavoring to secure information concerning the existence in the United States of what are usually known as establishment funds—that is, mutual relief or insurance funds organized and maintained by the employees of an industrial establishment, or relief funds supported either wholly or in part by the employers themselves. It is desired to obtain, wherever possible, copies of constitutions, rules and by-laws, blank certificate forms, and any other matter relating to funds of this character, which should be sent to Charles P. Neil, Commissioner of the Bureau of Labor, Washington, D. C.

Annual Meeting of the Ohio Interurban Railway Association and First Meeting of the Central Electric Railway Association.

The annual meeting of the Ohio Interurban Railway Association was held at the Algonquin Hotel, Dayton, O., on Thursday, January 25th. The meeting was an important one, since it marked the ending of the Ohio association and the inception of the Central Electric Railway Association. The meeting was called to order at 2:30 p. m., by Mr. E. C. Spring, Dayton, Covington & Piqua Traction Co., the retiring president of the Ohio association. He said that the first business to come before the meeting was the election of a temporary chairman and a temporary secretary. To these offices Mr. Spring and F. W. Coen, Lake Shore Electric Railway Co., were respectively elected.

A. W. Brady, Indiana Union Traction Co., secretary of the joint committee appointed to arrange for the consolidation of the two associations, then made a report of the proceedings of the committee. The minutes of the meeting of the committee at Indianapolis on January 11th were read. It was decided by the committee that the name of the new association should be the Central Electric Railway Association. Mr. Brady then read the constitution and by-laws recommended for adoption by the new association. It is provided in the constitution that the meetings of the Central Electric Railway Association be held on the fourth Thursday of the months of January, March, May, September and November, at a time and place to be designated by the executive committee. Special meetings are provided for at the discretion of the president and executive committee. The constitution and by-laws were adopted as read.

E. C. SPRING.

Mr. Brady then read the list of officers put in nomination by the committee, which list is as follows: E. C. Spring, Ohio, president; C. L. Henry, Indiana, and F. D. Carpenter, Ohio, vice-presidents; and W. F. Milholland, Indiana, treasurer. The executive committee to be composed of Harrie P. Clegg, Theodore Stebbins, F. J. J. Sloat, C. N. Wilcoxon and J. W. Brown, Ohio; H. A. Nicholl, C. D. Emmons, C. C. Reynolds, W. G. Irwin and G. F. Wells, Indiana. A unanimous ballot was cast and the foregoing officers elected. At a later meeting of the executive committee, J. H. Merrill, Ohio, was elected secretary.

The meeting then took up the election of new members and a number of applications were received and acted upon.

President Spring extended his thanks to the association for the honor accorded him and spoke of the achievements of the Ohio association and of the future work of the Central Electric Railway Association. He then introduced J. V. E. Titus, president of the Garton-Daniels Co., who had been invited to address the meeting. Mr. Titus read the following paper:

Lightning Protection.

BY J. V. E. TITUS.

It is almost unnecessary to say at the start that, however high flown the claims manufacturers make in advertising, a complete solution of the subject of lightning protection has not been made to date.

The progress in this direction during the last few years has been considerable. Heretofore the manufacturer of protective apparatus has had the burden of the proposition on his shoulders alone. The fact that the subject is receiving so much attention before different societies and associations, such as this one, promises well for the future. It is only by the most careful co-operation between operating companies and the manufacturer that the most rapid progress is made. It is hoped that the operating companies will give even greater attention to the subject now that they have been properly aroused to the situation that confronts the electric railway industry.

By a process of "natural selection" the practical method of protection has resolved itself to a choice of less than a half-dozen forms of lightning arresters. In all of these that have proven popular, there is the usual air-gap, over which the normal current alone cannot jump, but which offers an outlet to earth for the lightning. When the lightning does bridge this air-gap, the normal current usually follows. And it is the means provided to stop this flow of normal current, that gives the manufacturer a chance to tell so many conflicting tales about which of these means is the worst.

Some manufacturers try to prevent the normal current following the discharge at all. Some try to blow out the arc formed by the normal current, while some even try to cut it off by means of "moving parts." There are other ways used, each one of which has its defects.

All are pretty well agreed, however, that to have the air-gap of the arrester small is of great importance. Therefore, remarks relating to other features will prove of greater interest.

I shall first tell of some of the recent developments of the research and experimental work carried on by the Garton-Daniels Co. in the last few years. This work covered practically all types of arresters on the market at present, but was devoted almost exclusively to the improvement of the company's own product. And, as the greater portion of electric railway mileage is operated by direct current of 500 to 700 volts pressure, my remarks will be confined to this class of service.

With properly designed arresters, properly distributed and with good ground connections, no further precautions than careful inspection at frequent intervals can be taken.

In the design of a lightning arrester there may be all the difference in the world. It has been easy to make one that will discharge a circuit freely. It has been easy to make one that will prevent a continued flow of normal current following the discharge. But to combine both of these features in the same device has been quite a problem.

It is generally conceded that an electric line is a poor place to allow the lightning to linger. Experiments were made, therefore, as to the most efficient method of discharging a circuit. Lightning may be likened to water in some of its characteristics. When it breaks loose it goes with a rush. If a bucket of water were poured through a straw, a great deal of it would splash over; if it were poured through a large enough pipe, not a drop would be spilled. It is something like this with a lightning arrester. The path to earth must be as free from resistance as possible. With a high resistance path for the lightning, some of it may splash over and "wet" the machinery or insulation, as the water does if it is poured through a straw. But by making the resistance of a lightning path low, a complete and instantaneous discharge is insured.

Resistance in a lighting arrester may not impede the light static discharges to the extent that it does a sudden rush of current such as lightning. I believe Alexander J. Wurts, the eminent authority on lightning protection, has said that discharging lightning through a resistance in series with an air-gap, may be likened to the swing of a pendulum. If an empty glass jar is placed in the path of the pendulum the glass jar will be broken and the pendulum swing onward in its path freely. But if the glass jar is filled with water, the pendulum will break through the glass as a discharge

does the air-gap of a lightning arrester, but the speed of the pendulum will be greatly decreased by its passage through the water. The speed or freedom of passage of the discharge, is impeded by the resistance of a lightning arrester in the same way as that of the pendulum is by the water. Mr. Wurts therefore made his non-arcing lightning arresters for alternating current service perfectly free from any resistance aside from that of the air-gaps.

The foregoing remarks are completely confirmed by our research work and will establish the desirability of keeping the discharge path as free from resistance as possible. How this is done will follow in my further remarks. But our observation has been that to keep down the resistance in the discharge path is of prime importance in correct arrester design.

The distribution of a large number of lightning arresters along the line, in addition to those on each car and those at the station, is rapidly becoming standard practice. Its desirability is apparent for many reasons. Lightning shows a tendency to take the closest and shortest path to earth that it can find, even though it be of high resistance, as shown by the reports from long distance transmission lines. No arresters are used along such lines, as the development of arresters for such voltages has not yet reached the stage where they can be hung on a pole, unattended, to battle single handed with the most elusive of the elements. As a result, poles are frequently shattered by lightning discharges from the line, as well as direct discharges from the clouds. This is probably due to the inductive resistance of considerable lengths of even perfectly straight wires. This inductance tends to drive the discharge through the wooden poles and the insulation to the earth. Thus showing most forcibly the tendency of lightning to find an immediate outlet to earth.

By placing arresters sufficiently close together, say every 1,000 ft., or closer, where storms are very severe, the discharges are offered plenty of proper paths to earth, without endangering the machinery or the insulation.

In the event of very heavy discharges, such as frequently occur on long exposed interurban lines, it is almost impossible to have too many arresters. A large number insures each one doing its part of the work, and in this case there is no overplus to go through the insulation.

The nodal or non-discharge point theory has been well established and at such points a discharge will not go to earth. The use of a large number of arresters along a line insures a sufficient number of them at points where discharges will occur.

Furthermore, when a storm is of long duration and very severe, a certain part of the arrester equipment may be seriously damaged. The more arresters there are on the line, when such a storm begins, the more there will be at its ending. The more arresters used, the less service each one has to perform, and the less danger of its being overloaded, which shortens its life.

To insure proper ground connections at all times, we recommend a connection to the rail as well as to a ground point. There are several reasons for this, first of all our own. This is that the arrester requires a certain flow of normal current to properly actuate the cut-out. If the ground wire is not connected with the rail, there may be enough resistance between the rail and the ground point, to cut the current down to so small a value that the cut-out will not operate properly.

Another reason for the double connection is the probability of the static difference of potential existing between the rail and the earth—or between the rail and the line—particularly, if the rail is up on a rock ballasted road bed or set in cement or a soil that does not offer a good outlet for the discharge. By grounding to the rail as well as the earth, the arrester is placed in a shunt path around the car motors—under all circumstances—which affords them the best possible protection.

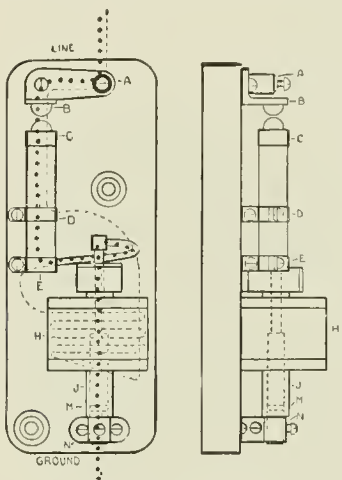
With ground connections to both rail and ground point, any corrosion or breakage of one of these connections, will leave the other intact in all probability, thus insuring at all times a good outlet for the lightning.

A regular inspection and test of all arresters should be made once a month and additional inspections after severe storms. At such times the discharge points should be observed and cleaned if necessary. Dust and dirt accumulated on the base should be blown away. A small pair of hand bellows is convenient for this work. If any evidence of damage is shown, the arrester should be taken to the repair room for test and overhauling.

Many electric railways are making a practice at the present time, of taking down all pole type lightning arresters during the winter months. These are given a careful test in the shop, particular attention being paid to resistance rods, to determine whether or not they have increased in resistance. Any repairs necessary are made in the shop where they should be, instead of on the line, where the lineman has poor chance of doing careful work.

It is careful attention to the small details of a lightning equipment that brings successful lightning protection, especially if the lightning arresters are of an efficient and durable design. The fact that we are in this case dealing with such an erratic and practically unknown element, should impress us with the need of unflagging effort to have the lightning protective apparatus at all times in first class condition.

While our experimental work covers many of the different arresters on the market, particular attention was given to our own types as previously stated. Service results had conclusively shown that while our make of arresters were highly efficient in discharging a circuit, that after a season or two of severe storms, the number of burned out arresters was disconcerting to say the least. Arresters that have been burned out are generally so completely wrecked, that it is difficult to find enough partially damaged ones, on which to base a report of the real cause of the trouble. But careful observation showed that the resistance rods were at the bottom of more than 60 per cent of the burn-outs. The composition of the rods available in past years was principally some combination of graphite or carbon with kaolin, a fine grade of clay such as is used in porcelain. Under the action of lightning these rods increased in resistance, almost beyond reason, for instance, a rod of 100 ohms would often be increased to 10,000 ohms resistance after a few storms. This high resistance was sufficient to choke back the lightning or force it to find another path to earth, frequently over the surface of the arrester base, resulting in its destruction, if the normal current followed this path. This increase of resistance seems to be due to the union of the free carbon and the silicon of the material from which the rod was made. The product of the union caused by the static discharge was a film of something like carbide of silicon or carborundum. This film existing between conducting particles was responsible for the increase in resistance.



DETAILS OF A LATE TYPE OF LIGHTNING ARRESTER.

This weakness of resistance rods has been entirely overcome by making them with a high percentage of metallic conducting materials. The other substances used are carborundum and kaolin to give strength and stability. The rods now produced by our company are not increased in resistance by the action of the static discharge.

Another cause of burn out was found to be the arrangement of the parts of the arrester on the base. When dust collected and, later on, moisture due to sudden changes of temperature, the discharge or even the normal current would flash across the base between arrester parts. This formed a short circuit and soon resulted in the destruction of the device.

To avoid the possibility of such an occurrence, the arrester parts have been so distributed on the base, that the line connection is at one end and the ground connection at the other extremity, as shown in the accompanying diagram. In this way parts of greatest difference of potential are most widely separated. In addition to the arrangement of parts, the method of supporting the resistance rod, as shown in the illustration, greatly increases the distance on the surface of the base, between parts of opposite potential. The rod is supported by clamps and brackets, D and E, which gives 2½-in. surface distance between B and D. The discharge point

C is cemented on the upper end of the rod, the other discharge point B being mounted on an adjustable bracket.

A brief description of the method of operation of this new type arrester may be of interest. The line connection is at the top of the arrester as shown. A discharge entering here passes downward in a practically straight path to ground connection. This path is indicated by the line in the illustration herewith. It will be noticed that the discharge goes through the entire length of the resistance rod C-D, the normal current being shunted through the solenoid coil H. This energizes the iron armature J, which raises upward in the coil, opening the circuit between the lower end of the armature and the carbon button M, which is connected with the ground binding post N, as shown at the bottom of this illustration. This starves the arc formed at the air-gap B-C, so that it is extinguished and the normal dielectric of same is reestablished. The coil loses its energy and the armature returns by gravity to its normal position. The arrester is instantly ready for another discharge. As the arc is broken between the iron armature J and the carbon button M, these two materials cannot stick or weld together. And as the circuit is opened inside the tube and the air-gap adjustment is always the same, it is possible to use the small air-gap standard in this type of arrester, that is, 1-40 in.

To limit the flow of normal current that can follow the discharge to ground, the upper section of the resistance rod B is used, there being approximately 50 ohms resistance between the discharge point C and the clamp D. This resistance keeps the current down to a value that is readily broken by the cut out, and is not enough resistance to impede the passage of the discharge.

It will be noticed that the parts of the arrester are readily accessible from the front. This allows a lineman to inspect, clean or repair the arrester without removing it from its box or the pole.

It has been my endeavor to avoid technicalities in these remarks, as the practical side of the question has resolved itself into the important one. What is wanted is results. To this end, comparative tests, of different types of arresters, should be made in the laboratory as well as in the field. No single laboratory test alone can establish the efficiency or durability of a certain arrester. These tests have been made, however, under all sorts of conditions, and the showing is something like that of the old photometric tests of incandescent lamps, made by different salesmen. These tests were certain to show the best results for the lamp the salesman was offering. There are certain test specifications for lightning arresters, that must be complied with, to give a fair result.

There is in New York City, as you are probably aware, a laboratory that undertakes just such tests. It's standing is of unquestioned character. It seems that its report may be relied upon as beyond appeal. It may, at least, to the fullest extent that any laboratory test can be. The ultimate test of real value is of course the one made in service—under widely varying conditions.

In the discussion which followed the reading of the paper, the question was raised as to the advisability of taking down all the arresters for repairs in the winter, since it had been the experience of several of the members present that severe storms accompanied by lightning were of not infrequent occurrence during the winter months.

Mr. Titus replied that it was not his idea to take all the arresters down at once, but to leave a certain number, say every fourth, to take care of possible emergencies.

In reply to the question as to the manner in which the arresters should be grounded, Mr. Titus replied that a cheap, durable and efficient way was to enclose the wire in a pipe driven eight or nine feet into the ground to a point where it will be in contact with moist earth. The pipe should also be extended eight or ten feet up the pole to prevent cutting the wire and there should be a soldered covering at the top of the pipe to exclude moisture. Station arresters should have for a ground a copper plate imbedded in coke or charcoal. Cast iron was suggested as being a possibly better material since corrosion resulted in the formation of iron oxide, which is a good conductor.

Mr. Stebbins said that about 17 years ago, he had been appointed to visit every electric railway plant east of the Mississippi River. In those days there was considerably more trouble from lightning than at present. In some cases every motor had been burned out by electric storms. He thought that the good insulation of the present armature windings was productive of better results. He thought the term "Lightning Arrester" a misnomer and suggested that "Lightning Diverter" should be used. He considered a good ground plate one of the most essential features of an arrester.

F. J. J. Sloat, Cincinnati Northern Traction Co., thought that a great deal of the trouble in regard to lightning arresters resulted from the connections to the rail spoken of in Mr. Titus' paper. He agreed with the already expressed opinion that a good ground was necessary and suggested a copper plate one foot square and one-quarter of an inch thick embedded in coke or charcoal.

In answer to questions regarding the location of arresters on single-truck cars and on poles, Mr. Titus replied that in the first case he thought the arrester should be placed between the wheels and well towards the center of the car body, and in the second case, at the top of the pole where they would not present an easily accessible target for marksmen.

President Spring then announced that the banquet would be held at 6 p. m. in the main dining room of the Algonquin Hotel and the meeting adjourned at 3:30 p. m.

Banquet.

The first annual banquet of the Central Electric Railway Association was held at 6:30 p. m. in the main dining room of the hotel. Some 300 members and guests of the association were present. The decorations and service were very elaborate, and the programs bore on the cover a fac-simile of the badge of the association. President Spring acted as toastmaster.

President Spring delivered an address in which he spoke of the work of the Ohio association and extended thanks to the association for the very excellent way in which it had supported its officers. He said that special thanks were due to Mr. Coen for his efficient work as secretary of the Ohio association. He spoke of the ending of the Ohio association and of the new Central Electric Railway Association and congratulated both states upon the unanimity of purpose which had made possible its formation. He said that the new association represented an invested capital of over $300,000,000. He extended his thanks to the association for the honor which it had accorded him in bestowing upon him its presidency and spoke of the obligation and responsibility which the office carried with it.

He then introduced as the guest of the evening, the Hon. W. Caryl Ely, president of the American Street & Interurban Railway Association.

Mr. Ely thanked the association for its courteous and hearty greeting and complimented it upon the high order of intelligence and efficiency displayed by its members. He said that he had in a way become one of them since he had street railway interests in the state of Ohio. The people of Ohio expected much of the street railway men in the state. He thought the street railway companies were entitled to the protection of the law and to the hearty support of the public. The methods used today should be fair and open if they were to bring success. They must be fair to be safe. He spoke of over-capitalization and its evils and thought that the law should be the same for corporations as for individuals in regard to liability. Corporations should not be compelled to issue more stock than they desire to.

Mr. Ely referred to the state board of railroad commissioners which supervises railroad operation in New York State and said that the investigations conducted by this board had brought good results. He spoke of the growth of the steam roads in the country from the year 1850, when their combined length was but 9,000 miles, to the year 1905, when the total had increased to 300,000 miles. The increase from 1900 to 1905 alone was 193,000 miles. He thought that the interurban railway mileage was increasing just as rapidly.

He spoke of the three-cent fare problem in the West and said that they were bothered with no such trouble in the East. He thought that publicity was doing more to rid electric railway companies of suspicion than anything else. He spoke of long term franchises and their advantages and disadvantages under various conditions. He also referred to the transfer problem and thought the companies should be more liberal in their issue. He said that in the state of New York, it is a misdemeanor for a person to misuse a transfer.

Mr. Ely then referred to the American Street & Interurban Railway Association and spoke of its reorganization. He extended to the Central Electric Railway Association, the best wishes of the American association for its success.

Mr. Coen then read letters and telegrams from H. H. Vreeland, president of the New York City Railway Co.; T. E. Mitten, president of the Chicago City Railway Co.; H. A. Everett, president of the Northern Ohio Traction & Light Co.; W. A. Bancroft, president of the Boston Elevated Railway Co., and W. K. Schoepf, president of the Cincinnati Traction Co., expressing their best wishes for the future success of the association and regretting their inability to be present.

President Spring then introduced the Hon. Chas. L. Henry, the retiring president of the Indiana Interurban Railway Association.

Mr. Henry said that it was a pleasant thing to die and be resurrected again in such a pleasing form as the Central Electric Railway Association. He spoke of the growth of the Indiana association and of the work that it had accomplished in the short period of its existence. He said that the great strength of the interurban line was contained in the fact that it was operated in the interests of the common people. He urged the delegates to always observe the people's rights. He closed by inviting all to attend the next meeting, which will be held at Indianapolis in March.

Harrie P. Clegg, Dayton Southwestern Traction Co., was the next speaker. At the conclusion of his remarks, he presented President Spring with a silver decanter, a gift of his business associates, who thus expressed their appreciation of President Spring's efforts in behalf of the interurban interests. President Spring responded briefly, thanking the gentlemen for their gift.

Henry W. Blake, editor of the "Street Railway Journal," was called upon. He said that Ohio is the greatest state in the union in the traction interests and that the work of the Ohio and Indiana associations is being watched with interest throughout the entire country and in the future the progress of the Central Electric Railway Association will be carefully followed.

Short addresses were made by T. Russell Robinson, of Boston; Judge C. W. Riley, of Detroit; Professor Bernard Swenson, secretary of the American Street & Interurban Railway Association; Attorneys J. S. McMahon, of Dayton, and A. F. Broomhall, of Troy, and Edward W. Hanley, of Dayton. The convention adjourned from the banquet hall at 11:30 p. m.

The Ravenswood Extension of the Northwestern Elevated Railroad.

The Northwestern Elevated Railroad Co., Chicago, Ill., has recently placed a contract with the L. E. Myers Co., of Chicago for the building and equipment of three and a half miles of double-track, third rail, elevated structure and one mile of double-track, overhead-trolley, surface line. This new work is known as the Ravenswood extension of the Northwestern Elevated R. R.

The elevated structure will begin at the main line of the Northwestern elevated between School and Roscoe Sts. and will extend to Western Ave., a distance of approximately 3.58 miles. From this point there will be a surface extension of approximately .91 miles to the terminal yards at Kimball Ave. The line will be built on private right-of-way with the exception of the street and alley crossings.

The elevated track construction will be similar to that now installed on the main line with minor changes in some of the details. The tracks of the elevated portion will consist of 80-lb. rail with the standard gage of 4 ft. 8½ in. Tracks will be laid 12 ft. center to center. The ties will be of yellow pine and on tangents will be 6 x 8 in. in section, 80 per cent to be 8 ft. long and 20 per cent, 9 ft. long. They are to be placed so that every fifth tie will be 9 ft. long with a one-ft. projection toward the center line of the structure. The ties will be spaced 18 in. center to center. Generally every alternate tie (except on inclines) is to be secured to the top flange of both the longitudinal girders of the track by means of hook bolts and washers. Each of the two ties under joints will be hook bolted at each end.

The rails on tangents will be 60 ft. long. The tie plates will be of flat steel 6 x 8 x ⅜ in. in size. The rails will be secured to the ties with steel screw spikes, having cold rolled threads. The screws will be ⅞ in. in diameter under the head and 5½ in. long.

The surface work will begin at the western end of the elevated structure, near the foot of the incline west of Western Ave. It will be laid of 80-lb. rail, the tracks being spaced 12 ft. center to center, with portions spaced 24 ft. center to center. The ties are to be of sawed or hewn white oak, 6 x 8 in. x 8 ft. in size. The joints will be suspended and Continuous rail joints will be used. Crushed stone will be used for ballast laid to a depth of 10 in. at the center of the ties with a top dressing 6 in. in thickness.

The plans and specifications have been prepared by E. C. Noe, general superintendent, and C. M. Mock, chief engineer of the Northwestern Elevated Railroad Co. and are complete and thorough in every detail. It is expected that the erection of the steel will commence about the first of April. The work will be pushed as rapidly as the weather will permit and the contractor will employ a full equipment of modern steam machinery in the prosecution of the work.

The Benton Harbor-St. Joe Railway & Light Co.

The traction interests of Michigan have recently been considerably furthered by the formation of the Benton Harbor-St. Joe Railway & Light Co. which was organized to succeed the Benton Harbor-St. Joseph Electric Railway & Light Co. The arrangement was effected at St. Joseph on January 27th and the new officers have been elected and installed. J. G. McMichael, president and treasurer of the Atlas Railway Supply Co., Chicago, Ill., is the president of the new company. The other officers are vice-president, C. K. Minary; general manager, H. C. Mason; auditor and treasurer, F. M. Mills, all of St. Joseph, Mich., and secretary, L. W. Botts, Louisville, Ky.

The improvements planned include an extension to Eau Claire of about 20 miles, this line to be later extended to Dowagiac and Cassopolis, making in all about 40 miles. A 52-mile line will also be built from Benton Harbor to Kalamazoo, passing through Paw Paw and Hartford. In all about 100 miles of new road will be installed.


J. G. M'MICHAEL.

The roadbed will conform throughout to high standards. The line to Eau Claire will be constructed of 60-lb. rail. On the remainder of the new work a 75-lb. rail will be used. The rail for the Eau Claire extension has been ordered and the work will be pushed rapidly. It is expected that this portion will be completed by June next and the other portions later in the year. The company is now reconstructing the overhead work of its city lines with No. 000, Figure-8 wire and also reconstructing the tracks in the city of St. Joseph, double-tracking the lines that have heretofore been single-tracked.

The rolling stock at present consists of 16 motor cars. The company has recently placed an order with the American Car Co. for four new cars to be equipped with the General Electric, GE-67 motors.

A power house has been built on the St. Joseph River near Benton Harbor and equipment to the value of $25,000 has been installed, all of which was furnished by the General Electric Co. The equipment includes two motor generator sets each consisting of 6-pole, 375-kw., 600-volt, compound-wound generators, direct connected to 12-pole, 400-kw., 2,300-volt, 60-cycle, 3-phase synchronous motors. These equipments are mounted on common bed-plates. Exciting current is furnished by 8-kw. capacity, 125-volt exciters. Power will be furnished by the Chapin Water Power Co. from its plant at Buchanan, Mich. This company will furnish power for the railway and lighting plants of the cities of Benton Harbor and St. Joseph and also for the Eau Claire extension. Including the power equipment the company has spent in and about Benton Harbor over $100,000.

Grading has been about completed and the concrete work nearly all put in for the extension of the Greensburg & Southern Ry. to Hecla, Pa. The track laying has been commenced, and it is expected that five miles of the road will be in operation in about 60 days. This property is owned by the West Penn Railways Co.

Annual Meeting of the Northwestern Electrical Association.

The Northwestern Electrical Association held its fourteenth annual meeting in Chicago, January 17th and 18th. The sessions were held at the Great Northern Hotel and were attended by about 100 members. The Electrical Show held at the Coliseum in Chicago at the same time proved of considerable interest to the visitors. The opening session of the convention on Wednesday morning was called to order by President Chas. H. Williams of La Crosse, Wis.

President Williams delivered a short address in which he welcomed the delegates and outlined the order of business of the convention.

Secretary Thomas R Mercein said that owing to the press of his duties in connection with the Electrical Show, he would not be able to be present through the entire session of the convention and H. D. Goodwin, official stenographer of the association, was appointed to act as secretary. Mr. Mercein read the report of the committee on legislation submitted by S. B. Livermore of La Crosse, Wis., the chairman of the committee. The report occasioned considerable discussion and it was suggested that an attorney be appointed in each state to take care of the central-station interests. Upon motion the matter was referred to the executive committee.

President Williams then appointed a committee on membership which was composed of J. H. Harding, of La Porte, Ind., W. H. Winters, of Darlington, Wis., and Irving P. Lord, of Waupaca, Wis.

The first paper of the convention was then read. In the absence of the author, Mr. Lord read Mr. Barrett's very interesting paper entitled "The Proper Handling of Consumers' Meters." In the discussion which followed, Mr. Winters, Mr. Adams and Mr. Kimball presented some very interesting information. The convention then adjourned until 2 p. m.

The afternoon session was devoted to the reading and discussion of three papers. The first was that of P. H. Korst, of Janesville, Wis., entitled "Suggestions for Increasing the Power Output of Central Stations." Mr. Korst described the method of charging and the rates which should apply. He also devoted some attention to soliciting and advertising.

President Williams appointed a nominating committee composed of Messrs. Gonzenbach, Lukes and Harding.

The next paper on the program was that of W. D. Burford, of La Crosse, Wis., on "Modern Underground Construction." Mr. Burford presented a very interesting paper which he illustrated by a number of lantern slides. G. B. Springer, of Chicago, discussed this paper, also illustrating his remarks by slides.

The last paper of the Wednesday session was that of George Williams of Madison, Wis., on the "Organization and Development of a New Business Department." Harold Almert, of Chicago, read a written discussion of this paper. The meeting then adjourned until Thursday morning.

On Wednesday evening the members of the association attended a very enjoyable theater party at the Great Northern Theater.

The Thursday morning session of the convention was devoted to the reading and discussion of C. J. Davidson's paper entitled "Government Tests on Fuels," and John S. Allen's paper entitled "Successful Applications of New Business Methods."

The first paper read before the convention on Thursday afternoon was that of Ernest Gonzenbach of Sheboygan, Wis., entitled "The Economy of Combined Railway & Lighting Plants," which paper we present herewith.

The Economy of Combined Railway and Lighting Plants.

The above title is not particularly novel and the subject is one which has been practically settled in many medium and small sized cities. If the proof of the pudding is in the eating, then a large number of combined railway and lighting plants must have an agreeable taste in their palates. The subject is, therefore, presented not in the light of a new discovery, but rather as a discussion of what has already been accomplished.

Electric lighting and railway enterprises are much more closely allied than appears on the surface, and it is rather strange that there are so many plants still operating separately. Both types of plants are dependent upon the home marketing of one and the same product. The raw material, method of manufacturing and distribution of the manufactured product are exactly the same in both cases. The only difference is in the class of customers. In the one case the product in the form of electric lighting is marketed to the upper and generally well-to-do classes and in the form of power to business houses, while in the other case the product is marketed in a somewhat different form to the masses who utilize the cheap transportation facilities afforded by electric cars. It seems to the writer, therefore, that there is much more logic in the combining of railway and electric lighting enterprises than there is in the combining of gas and electric lighting enterprises. The manufacturing plant and method of distribution of the latter two are radically different and invariably require separate and distinct organizations.


HAROLD ALMERT.

It should be understood that in this paper the term "lighting plant" covers a system equipped to handle commercial electric motor supply, and in all references to such a plant, its load curves and load factors, the electric motor load has been given due consideration and it is assumed that all plants of this nature have their due proportion of motors on day circuits.

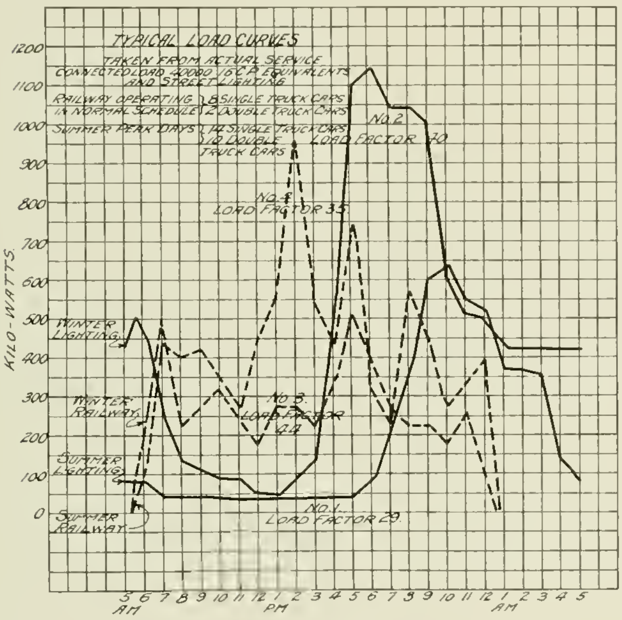
It is rather unfortunate that at the present time most of the combined railway and lighting plants which are in operation are the result of consolidations of two or more corporations which originally had independent existences. The natural result is a lack of uniformity in the producing plant which time and the natural wear and tear of apparatus only can eliminate. We still see in too many cases a power station equipped with separate generators and engines for lighting and another plant to handle the railway load. The two sides are generally combined in the boiler room, but some plants have gone so far even as to separate the steam generators. This is sometimes necessitated by the excessive fluctuations of the railway load, combined with insufficient steam piping and inefficient regulating devices. Such an arrangement of the plant is unavoidable in many cases when the exigencies of business will not warrant the installation of new and uniform equipment. On the other hand, such plants are not getting the benefits of the best economy possible by the operation of the combined service. It is the writer's intention to here discuss a plant which is to be constructed in conformity with modern practice, and which shall be interchangeable as nearly as the nature of the two classes of service will permit.

It should be unnecessary to call attention to the economies resulting in the office work of the combination service. It is needless to say that one executive head will exercise competent supervision over both classes of service, and his assistants may be skilled in their respective branches without necessarily possessing the executive ability which would in some manner have to be paid for under separate operation. One of the little economies which has an important bearing in this case is the fact that in the railway plant the heaviest loads occur during the summer months, particularly during July and August, which are the months of least activity in the lighting department. It is quite customary for railways to require extra office help and maintenance crews during the summer season. In the lighting plant the busy season occurs during

the months of November and December, and it is at that time that the lighting plant may be compelled to go to some extra expense to take care of the increasing business. It is an actual fact that in a well organized office the two classes of service work hand in hand in such a way that no extra help will be required at any time. The lighting force is at liberty to give some help to the railway force during the busy summer season, and vice versa during the winter season of heavy lighting.

It is particularly fortunate that the two classes of service have their maximum annual peaks at different times during the year, and the benefits of this condition are particularly appreciated in the production department, otherwise the power station. It is a well known fact that so far nearly every lighting plant in existence has a treemndous peak lasting from one hour to two hours, and occurring near 5 p. m., during the winter months.

This peak is particularly high during November and December. At such times the load factor of the lighting system is apt to be in the neighborhood of 30 per cent, even with a good motor load, and all this extra equipment to handle peaks must be installed and interest paid on it for the rest of the year. In other words, about 50 to 75 per cent of the equipment of the lighting plant is earning



CURVES OF RAILWAY AND LIGHTING LOADS.

money only for perhaps 150 to 200 hours during the entire year. The rest of the time it is not engaged in anything else except the absorption of interest and depreciation.

In a railway plant the peak loads occur during the summer season and particularly on Sundays and holidays. The amount of idle investment in the railway power station is not nearly as great as it is in the lighting plant, but nevertheless a considerable amount of equipment has to be held in reserve to take care of the excessive loads which occur on perhaps 15 Sundays and holidays during the warm months. It is customary for railway plants to operate with a smaller percentage of reserve apparatus than is usually found in lighting plants. On account of the very fine regulation demanded by the lighting system it is quite difficult to crowd that class of apparatus beyond a reasonable limit. The regulation of railway apparatus is ordinarily overlooked and the owners as well as the public close one eye to its defects. It is, therefore, possible to neglect the reserve capacity of the railway station, a fact which is taken too liberal advantage of by many existing properties. In any case, it is advisable to have some reserve capacity, and it is one purpose of this paper to show that this reserve may be obtained in a combined plant without excessive idle invesment.

The diagrams shown represent a series of typical local curves the characteristics of which are taken from actual daily averages of a plant in a small city. The curves approximate very closely the true conditions found in any city of between 30,000 and 50,000 population. The curves may be itemized as follows:

No. 1 represents a typical summer load curve of the lighting system. It will be noted that the peak of this curve occurs from 9 to 10 p. m., and amounts to 625 kw. This curve gives a lighting load factor of 29 per cent.

No. 2 represents a typical lighting load curve for the same plant taken during a day in the month of December. It will be noted that the peak in this curve falls between 5 and 6 p. m., and amounts to 1140 kw. This gives a load factor of 40 per cent.

No. 3 represents the railway load curve on a typical winter day. It will be noted that the peak occurs at 5 p. m., and amounts to 500 kw. The load factor of this curve is 44 per cent.

This winter peak of the railway circuit coincides very nearly with the winter lighting peak, and the resultant peak will reach about 1600 kw. It is somewhat unfortunate that these two peaks occur simultaneously but on a broader view of the question the disadvantage is not nearly as great as appears on the surface.

No. 4 represents a typical railway curve on a summer holiday. The maximum peak occurs at 2 p. m., and amounts to 950 kw. Another peak occurs at 5 p. m., and amounts to 740 kw., and a third peak at 8 p. m. amounts to 500 kw. Finally there is a fourth peak about 12 midnight.

These four peaks occur at times when people flock in very large numbers to and from parks and amusement resorts. The load factor of curve No. 4 is 35 per cent. It will be noted that the 8 p. m. peak practically coincides with the peak of curve No. 1 and the sum of both is about 1150 kw., which is almost exactly the peak of the winter lighting load alone.

The load factor of the combined summer curves is 53 per cent and of the combined winter curves only 28 per cent.

[At this point the author suggested that the load factor is equal to the average load divided by the maximum load and not the average load divided by the station capacity, the latter being the station factor.—Ed.]

In the case of railway plants operating a considerable surburban or interurban system in addition to the city system, the lighting load becomes a smaller fraction of the total load on the plant and the load factor will be very much improved. It is not the purpose of this paper, however, to consider such cases, but to take an abstract example from actual daily service. The railway load curve represented in the diagram calls for the operation of 8 single-truck local cars and two double-truck suburban cars. The local cars are supplemented between 5 and 6 p. m., by two or more extra double-truck cars to take care of traffic during the rush hours. The lighting load shown in the curve represents a total connected number of lights of about 40,000 equivalents of 16 c. p., lamps, and including a large number of stationary motors, as well as city street lighting.

Considering now that the two plants, the railway and lighting, are separate and distinct corporations, and each has its own independent plant, it is interesting to calculate what the cost of equipping the power station will amount to. The lighting plant calls for a maximum of approximately 1200 kw., and it will be necessary to install that amount of machinery. Furthermore, prudent management demands that at least 25 per cent reserve capacity be installed in order to meet emergencies. This will call for a total power installation of 1500 kw. Regardless of the manner in which this station may be subdivided into individual units, we may estimate a total cost of power station, including engine and boiler room and everything else complete at $125 per kw. For the 1500 kw. power station, therefore, we must make an appropriation of $187,500.

The railway company will also require a power station of its own in the case here assumed, and as the total maximum demand during the summer months is 950 kw. and 25 per cent reserve capacity must again prudently be provided, we must assume a power station with a capacity of 1200 kw. in railway generators. This, at the same price per kw., will cost $150,000.

The combined cost of both the railway power house and the lighting power house will, therefore, amount to $337,500.

If we combine the two plants and operate both the lighting and railway loads from one station, with one class of prime movers, we will have a maximum demand at peak loads during the winter months of 1600 kw. It is in this case also prudent to provide 25 per cent reserve capacity and this will call for a power station having 2000 kw. in generators, engines and boilers. The same cost,

$125 per kw., will make this station cost $250,000, a saving of $87,500 in the first cost of the plants. Allowing 10 per cent for interest and depreciation, the saving on this score alone amounts to $8,750 annually.

Besides this saving in first cost, the saving in cost of operation is very considerable. One chief engineer only instead of two is required. There are only half the shift engineers required which would be necessary under separate operation, and the same rule holds true down the line as far as the coal passers. It is safe to say that the cost of labor will be about 33 1-3 to 50 per cent less in a combined plant than it is under separate operation. In addition to the saving in labor the fuel economy is decidedly improved. In a lighting plant boilers and engines work under disadvantageous conditions, as a rule, during light loads. The engines may be only partly loaded, therefore not giving their maximum efficiency. The same holds true of boilers. In the combined plant above referred to, with a capacity of 2,000 kw. subdivided into, say, four 500-kw. units, two of them alternating current, one combination unit of the kind referred to below, and one direct-current unit, it is impossible to so operate the plant that there will always be a full load on one or more of the units. This gives the maximum efficiency. Data taken from a plant of this kind now in operation shows that the saving in labor and fuel economy amounts to about $6,000 per annum over and above the operating cost of separate plants. Add to this the $8,750 saving in interest and depreciation and we get a total of nearly $15,000 per annum saving accomplished in a plant of the capacity and dimensions referred to. Fifteen thousand dollars will pay interest on $300,000 of bonds or it will provide a neat little sinking fund or stock dividend. At any rate, it is an item which no prudent railway or central station manager would care to overlook.

It may be urged against this plan that it is not practical to operate a railway and lighting load from the same generators and engines. The best reply to this criticism is that it is not a theory which we confront, but an accomplished fact. There are today a number of well designed power stations which supply lighting and power from one class of generators, and there seems to be no reason why the type of units in the power station of this class may not be identical at least within the limits outlined above. The writer has in mind for a plant of this sort, direct connected units operated at 60 cycle. The direct current for the railway operation may be supplied through either motor generator sets or through one or more combination sets consisting of alternating-current and direct-current generators connected together, and connected with a clutch coupling to the engine. The latter is a much more economical plan, as during light loads the railway generators may be operated from the alternating-current machines working as synchronous motors, thus reducing the number of prime movers in operation and giving a very high demand factor. During peak loads the engines may be connected to these combination units through the clutch couplings, and both the alternating-current and direct-current machines may be used as generators, each doing its respective work. In water power stations such an arrangement is even more valuable than it is in a steam station.

Regarding the operation of direct-current railway units from synchronous motors taking their current from lighting generators. This is a feat which is being accomplished today and will be still more in the future than it is at present. It requires careful design of the generating units and requires close regulation in both generators and the engine governors. A Tyrrill regulator on the lighting lines will counterbalance any tendency to fluctuation caused by the railway load. A comparatively small storage battery will accomplish wonders in the way of regulating the fluctuating demand on the railway generators, and will enable both classes of service to be furnished from one machine, besides reducing the amount of railway apparatus which must be held in reserve.

In conclusion the writer begs to state that it has been his intention not to go into this situation from a technical standpoint. It is his idea to bring out some of the commercial and economical features of the operation of combined plants for the purpose of starting a live discussion of the question at this meeting.

In the discussion which followed the reading of Mr. Gonzenbach's paper, Mr. Korst said that he had been selling power to his local street railway as well as supplying current for lighting purposes and that he had found the scheme of using one set of machines as generators for both classes of service worked very well.

J. M. Warring, of the Electric Storage Battery Co., said that in regard to the combination railway and lighting station mentioned in Mr. Gonzenbach's paper where the street railway generators are driven by synchronous motors, he had in mind a case at the plant of the Peoria Gas & Electric Co., where they are operating in this way. The direct-current generators in this case are supplying power to a 500-volt circuit, but as the load is a fluctuating motor load, it is similar to the plant referred to by Mr. Gonzenbach. In this case, the power load held on for about one hour, during the heaviest lighting peak and a storage battery was installed not only to relieve the station of the load fluctuation, but also of the entire power load for a period of one hour.

In combination lighting and railway plants the value of storage batteries is often greatly increased by installing them in such a way that they are suitable for operation on either the railway or lighting services. In many instances the heaviest lighting loads occur during the winter months and the most severe railway peaks during the summer months, so that a combination battery can be operated to great advantage throughout the entire year.

As an illustration of the economies of operation that can be effected by batteries, Mr. Warring cited an example in Chicago. On one of the large elevated roads a test was made during the month of January before the installation of batteries on the system, and a similar test was made during January of the year following, after batteries had been installed. It was found that due to the increased speed, the load had incerased 25 per cent but that the boiler load at the power house had decreased approximately 10 per cent, due to the battery installation and notwithstanding the increased output.

Mr. Jackson, of Madison, Wis., said that this was a subject in which he was greatly interested. He thought the combination of railway and lighting plants more satisfactory than the combination of gas and electrical palnts. He thought that in a medium-sized town the combination would be to the advantage of both the consumer and the operator, but that in a plant of any considerable size the two factors should be operated separately. He had tried combination and found that it did not work. The employes were, as a rule, not adapted to the combined work. He thought that the reduction in the cost of labor of from 33 1-3 to 50 per cent, which Mr. Gonzenbach mentioned, was rather excessive. In regard to the chief engineer for a combined plant, it would take a better and consequently a higher priced man to fill the position. He said that there were times when the street railway load was as high in winter as in summer, such as when the snow plows were used to clear the tracks of snow. He thought that the combination of the two plants admirable under proper conditions and cited examples.

Applications for membership were taken up and a number of new members elected. The last paper of the convention, that of R. N. Kimball, of Kenosha, Wis., entitled "The Effect of Load Factor on Station Costs," was read. The nominating committee presented the names of the following officers for election: Harold Almert, Chicago, president; E. B. Kirk, Oshkosh, Wis., first vice-president; Frank J. Baker, Evanston, Ill., second vice-president; B. Adams, Madison, Wis., secretary and treasurer, Irving P. Lord, Waupaca, Wis.; C. H. Williams, La Crosse, Wis., and Robert N. Kimball, Kenosha, Wis., directors.

The secretary was instructed to cast a unanimous ballot for the gentlemen named.

Mr. Almert, the new president, has been for the past three years the general manager of the Cicero Light, Heat and Power Co., and consulting engineer for several other plants. He has successfully filled positions with the Chicago Telephone Co. and several well known electrical firms and is well fitted for the duties of the office which has been intrusted to him.

On Thursday evening the members of the association were the guests of the managers of the Electrical Show and attended the show in the body. A meeting of the Executive Committee on Friday morning closed the work of the convention.

It is announced that work will be begun immediately in the conversion of the West Shore Ry. between Rochester and Syracuse, N. Y., a distance of 81 miles, for electrical operation, and it is expected to finish the work by March 1, 1906.

The Economical Maintenance of Equipment as Discussed at the New England Street Railway Club.

Mr. Albert B. Herrick, of New York, was the speaker at the regular meeting of the New England Street Railway Club in Boston at the American House, January 25th. The subject was "Pointers in the Economical Maintenance of Street Railway Equipment." A large number of drawings showing the results of the speaker's tests on different roads were exhibited.

The abnormal maintenance of the street railways east of the Mississippi River, between Canada, Kentucky and the Atlantic Coast was said to be $17,500,000 per annum. The cost of maintenance varies enormously per car mile on different systems and the character of service, grades, curves, stops per mile, etc., appear to have nothing to do with the problem. In most cases examined by the speaker the lowest maintenance occurred with the most severe service. In a special case Mr. Herrick stated that the transferring of the car-mile maintenance cost of one road to another system would mean an annual saving of $1,000,000. Harmony between the operating and the maintenance departments is essential for low maintenance figures and in cases where officials visit other roads and learn the best practices away from home the resulting maintenance cost is sure to be lower than in the case of isolated, provincial lines which do not take account of progress elsewhere. The anticipation of defects likely to occur is more important than is generally realized. The old motto, "A stitch in time saves nine," applies with force to street railway maintenance. Mr. Herrick urged the desirability of figuring the fixed charges upon power stations in addition to coal, labor, oil and waste in determining the exact cost of generating power. It is purely a manufacturing process.

After thus outlining the importance of maintenance the speaker briefly described his autographic test car and the work it is capable of doing. About 8,000 miles of track and 2,700,000 rail bonds have been tested by this car. Bonds are tested usually with a current of about 200 amperes, which is applied to the track through the front and rear trucks, the drop being recorded on a moving strip of paper through which a high tension discharge passes, the discharge position being determined by allowing it to pass through the paper from a special millivoltmeter needle. Tests are usually made with the car running 10 m. p. h. With this equipment feeder systems can be investigated copper re-distributed when necessary, re-inforcements added, annual losses in overhead lines and track determined, the condition of bonds and ground returns plotted, defects located and rolling stock performance analyzed. By connecting the equipment to a line of track about a fifth of a mile long, but out of sight and knowledge of motormen, an accurate line can be secured upon their performance and upon the power consumption of many different cars. In this way a car test can be made in eight seconds. One of the greatest wastes in the street railway business comes through poor maintenance. Mr. Herrick cited one road which was being held for sale, in which dividends were declared without proper maintenance charges. In four years the power consumption rose from 1.8 to 3.5 kw. h. per car mile. The crux of the maintenance situation is the motor temperature. Mr. Herrick measures this by attaching a thermometer to the shell, the thermometer being held in place by a magnet. He considers the temperature of the shell ten minutes after a shut-down to be for all practical purposes that of the motor as a whole.

In the discussion which followed the conclusion of Mr. Herrick's address several topics were touched upon. It was brought out that the ground resistance varies greatly with the temperature near the salt water. A fair average of earth resistance can be taken as 40 ohms per sq. yd. of earth against the rail, and 120 ohms per sq. yd. of concrete. In Mr. Herrick's experience apparatus designed ten years ago shows the lowest maintenance cost. He spoke very highly of the Westinghouse 12A motors used in Albany, N. Y., on the score of low maintenance. The safe temperature of a railway motor in all day service should not exceed 22 degrees C. rise above the surrounding air. Ground plates were severely criticized on account of their rapid oxidation and consequent increase in surface resistance.

Mr. John W. Corning, of the Boston Elevated Railroad Co., stated that he had found a regular increase of load on that system with decreasing external temperatures. It amounts to seven-tenths of one per cent per degree drop, between 70 and 10 degrees Fahrenheit.

Mr. Herrick's opinion of welded joints was asked, and he stated that electrically welded joints give the best condition of track, electrically. The resistance is exceedingly uniform. Cast welded joints are excellent if made at the right temperature, but if the joints are welded with a constantly cooling flow of metal, they are inclined to grow poor as the temperature of the weld decreases. Mechanical bonds need to be put in by first class men if the results are to be satisfactory. Damp weather is no time to bond. The best bonded track is that in which compressors were used. Soldered bonds should be mechanically strong and not fall off under the jar of continued service. Power consumption of cars is increased by the common fault of cutting in the current before the brake shoes are released and by operating with brake shoes set too close against the wheels.

A Broader Field for Rossiter, MacGovern & Co.

The announcement has been made that Rossiter, Mac Govern & Co. will engage in engineering and contracting work of a general nature. The capital of the company has been doubled and Mr. J. C. Brackenridge has been elected president. Rossiter, Mac Govern & Co. was founded about fourteen years ago for the purchase and sale of electrical and steam apparatus. Such a satisfactory amount of business was handled by this enterprising firm that about seven years ago it became necessary to incorporate the company. The amount of business now handled in the electrical field places this company among

J. C. BRACKENRIDGE

FRANK S. MAC GOVERN.

the foremost firms that sell electrical apparatus other than the large manufacturing concerns. Together with the establishment at New York City, this firm has a repair shop in Jersey City, and business offices in St. Louis and Boston. It is proposed to erect in New York City a shop similar to the present one in Jersey City. As announced, the personnel of the company will be increased so that its engaging in engineering and contracting work will in no way affect the management of its branch engaged in buying and selling electrical and steam apparatus.

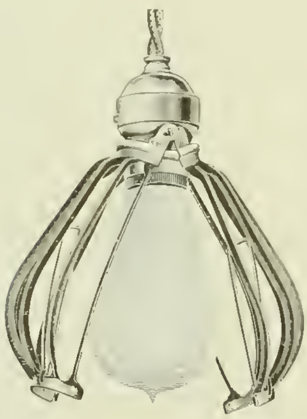
Mr. J. C. Brackenridge, who has become president of the company, is prominent in the electrical field through his association with the Brooklyn Rapid Transit Co., which extended over a period of ten years. During this time he was first chief engineer and later general manager. It was under his charge that many of the recent power stations were built and the elevated structure equipped for electrical operation. He also was instrumental in extending the schedules of the elevated trains across the Brooklyn bridge. During the past two years Mr. Brackenridge has been commissioner of public works of Brooklyn, which office he held until the first of the year.

Frank Mac Govern will continue as manager of the company which has been brought to so prominent a position largely through his efforts. Mr. Mac Govern is vice-president as well as general manager and James R. Floyd, Jr., is treasurer. The former president of the company, Clinton L. Rossiter, retains his membership to the executive committee and will be actively engaged in carrying on the old and extending the new work.

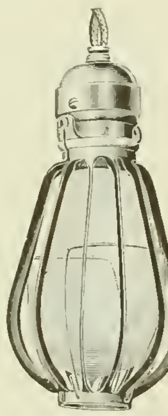
A New Lamp Guard.

Incandescent lamps which are suspended by a cord in places where they are liable to be broken and where their breakage would endanger fire, such as in safes and vaults, are usually protected by some form of guard. To meet this need the Benjamin Electric Manufacturing Co. has placed upon the market its "Can't Break" lamp guard.

The illustrations show the guard both open and closed, and present its details very clearly. It is of simple design and of but few parts. The two halves are each pressed from sheet steel, with



THE "CAN'T BREAK" LAMP GUARD OPEN.



LAMP GUARD CLOSED.

two hinge joints at the top and two locking joints at the bottom. The lamp is centered by an auxiliary spring wire, which keeps it from striking against the body of the guard.

The sheet steel forming the guard is pressed up edgewise radially with the lamp. There is consequently little shadow and the loss of light is reduced to a minimum. The guard is easily removed and as easily readjusted.

Report of the Third Annual Convention of the American Railway Mechanical & Electrical Association.

The American Railway Mechanical & Electrical Association has issued its report of the third annual convention of the association held in Philadelphia on September 25th and 26th. The report contains the minutes of the convention in which are included an address of welcome by Mayor Weaver of Philadelphia, an address by the Hon. W. Caryl Ely, president of the American Street & Interurban Railway Association, and the annual address of the president, C. F. Baker.

The minutes also include the reports of the various officers and committees and a number of interesting papers including "Power Distribution" by C. H. Hile, superintendent of wires, Boston Elevated Railway Co., "The Power Station Load Factor as a Factor in the Cost of Operation", by Lawrence P. Crecelius, chief electrician of the United Railways Co., St. Louis, Mo., "The Series-Parallel Railway Controller" by W. A. Pearson, electrical engineer of the New York City Railway Co. and a series of papers on the treatment of rail joints by G. E. Pellissier, civil engineer for the Holyoke Street Railway Co., H. B. Nichols, engineer of way and C. B. Voynow, assistant engineer of the Philadelphia Rapid Transit Co., T. W. Wilson of Buffalo and Fred G. Simmons, superintendent of construction of the Milwaukee Electric Railway & Light Co. There are also included a paper entitled "The Power Station" by Fred M. Bushnell, chief engineer of the Rhode Island Co., and one by F. F. Bodler, master mechanic of the United Railroads of San Francisco, entitled "An Emergency Track Brake".

The report contains some 300 pages and is a complete record of the transactions of the convention. Much credit is due S. Walter Mower, secretary-treasurer of the association, for his efficient work in compiling the report. In the future this association will be known as the American Street & Interurban Railway Engineering Association.

General Passenger Department for the Twin City Rapid Transit Co.

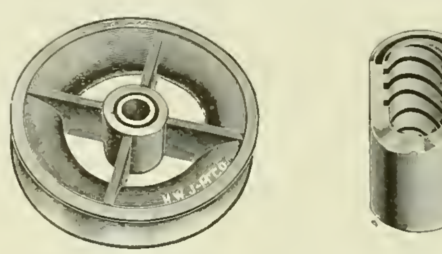
In line with the popular movement on the part of transportation companies throughout the country to spread the idea of "seeing America first" among the public, the Twin City Rapid Transit Co. proposes to do its share of the work by educating the residents as well as the transient population of the cities of St. Paul and Minneapolis, to see what nature has done for them. To that end a general passenger department has just been organized to take care of this special traffic. General Manager Willard J. Hield has announced the appointment of A. W. Warnock as general passenger agent.

The company will make its plans so attractive that schools, societies and private parties will consider it a privilege to make use of the lines. Chartered cars are to be advertised and tours are to be arranged for parties. Western roads bringing personally conducted parties have signified their wish to include the twin cities in their itineraries and the street railway company hopes to do some good educational work for the twin-metropolis in a way that has never been attempted before.

The Johns-Manville Trolley Wheel.

Experience shows that in the manufacture of trolley wheels the combination with the copper of such materials as arsenic, antimony, bismuth, tin, lead and spelter should be avoided. These elements, however sparingly used, seriously affect the electrical conductivity of copper and shorten the life of the wheel. They also render the copper harder and greatly diminish its ductility, the result being that the trolley wheel cuts the wire and both the wheels and the overhead construction require frequent replacement. To obviate these difficulties, the H. W. Johns-Manville Co., New York City, has recently placed on the market a wheel which is said to be made of absolutely pure copper, purified and toughened by a secret special treatment. These wheels have been subjected to the test of service and are said to wear smooth and even and not pit, arc or burn.

In the manufacture of the wheels only the best grade of pure lake copper is used. This material is treated chemically, reducing to a minimum any ingredients which the copper may contain in its crude state. By a further chemical process, the action of the atmosphere is excluded and the copper subjected to the action of carbon to remove the oxygen and to render the copper solid when cast, thus increasing its malleability and durability. Another process toughens the metal when hardening it and the wear is reduced



THE JOHNS-MANVILLE TROLLEY WHEEL.

to a minimum, the conductivity of the wheel being equal to that of the wire.

These wheels are furnished with the company's special bushings which are made from a metal peculiarly adapted to this purpose. The tenacity of this metal is said to be equal to mild steel with a compressive strength of about 130,000 lb. per sq. in. It is further claimed that its ductility and toughness are such that it will not crack when distorted by this load and that when subjected to heat, it will not harden and therefore is less susceptible to wear. These bushings are packed with a specially prepared packing, which is not only anti-frictional but also a lubricant of the highest grade

The American Railways Co. of Philadelphia has recently taken over the city and connecting lines of the Scranton Railway Co., Scranton, Pa. The American Railways Co. is planning many improvements in the lines which will be effected in the near future.

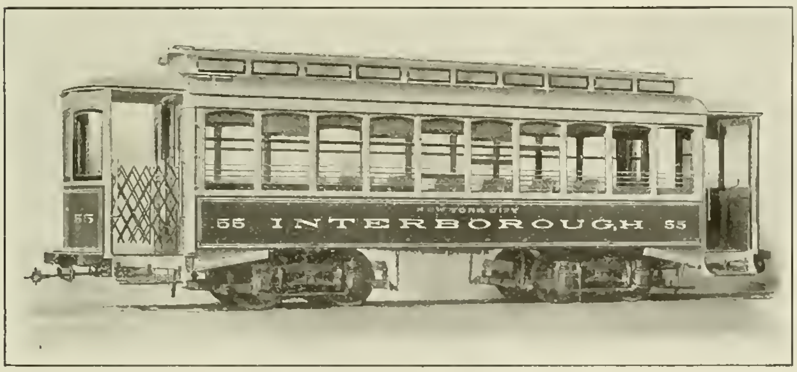
New Semi-Convertible Cars for the New York City System.

Ten grooveless-post semi-convertible cars built by the J. G. Brill Co. recently have been placed on the lines of the New York City Interborough Railway Co. in the borough of Bronx. While the Brill Co. has furnished a large amount of the equipment for the New York City lines, these are the first of its patented semi-convertible type to be ordered by the company. The cars are for operation on lines which connect with the elevated and subway systems, and while the lines were laid out primarily as feeders for these systems, they handle a large amount of local traffic in the

INTERIOR OF THE NEW BRONX CAR.

borough of Bronx as this section of the city is now almost solidly built up and has its own business center and shopping district.

The spaces between the outlying sections at the northern end of New York City north of the Harlem River and the cities of Mt. Vernon and Yonkers, are fast closing up. The excellent transportation facilities and the low rate of fares are resulting in the opening of streets and the building of houses throughout all this section. The system includes the fine suburban towns of New Rochelle, Mamaroneck, White Plains and Tarrytown, with the main lines running out the old Boston post road, skirting the Long Island Sound, and the historic White Plains post road and a wide, splendidly paved thoroughfare along the Hudson to Tarrytown, which



NEW BRILL CARS FOR THE BRONX.

is a continuation of Broadway, New York. These lines are connected with cross lines from the Sound to the Hudson, so that the whole section twenty miles beyond the Harlem River is well covered and new divisions are constantly being added. Bronx Park, with its fine zoological and botanical gardens, and Van Cortland Park, with its public golf links and large skating rink, are reached by the lines and many persons use the cars for pleasure rides as from many points the palisades of the Hudson may be seen as well as the beautiful islands and headlands of the Sound.

The form and dimensions of the bottom framing and upper structure of the cars is what the builders consider to be the standard for the length of 28 ft. over the body, with the exception of the straight sides and the fact that the platforms are 5 ft. long instead of the usual 4 ft. 8½ in. The grooveless-post semi-convertible window system is too well known to need description, and as the photograph shows the details and general appearance of the type, it is needless to repeat them. Attention, however, is directed to the long transverse seats and wide aisle obtained in this width of car, by the absence of window pockets in the side walls. The longitudinal seats at the corners each take up two windows, a plan which is being adopted by many of the large city systems which use a transverse seating arrangement. The last cars built by the Brill Co. for Philadelphia, Baltimore and Chicago, included this arrangement.

The interiors are finished in cherry stained to a dark color and the ceilings are of birch veneer with neat decorations. Brill patented specialties are used for the fittings. The trucks are of the Brill No. 27-G-1 type with 4-ft. 6-in. wheel base and 33-in. wheels. The cars are capable of a speed of thirty miles an hour.

Lincoln Park.

WORCESTER CONSOLIDATED STREET RAILWAY CO.

The Worcester Consolidated Street Railway Co. owns and operates Lincoln Park, which is located on the shore of Lake Quinsigamond, a distance of about two and a half miles from the center of the city of Worcester, Mass. The principal attractions are operated by the company, the smaller ones being leased. They include a rustic theater, seating about 2,200 people. Vaudeville is the principal form of entertainment provided, although recently a few operas and musical comedies have been introduced, as it is found that the public demands a variety. There is also a dance hall 50 x 150 ft., which is a favorite attraction, and on pleasant evenings it is not unusual to see over a thousand people in and about the hall. A skating rink and bowling alley, both of the latest and most approved type, have been found to pay a good percentage on the money invested. The park is managed by J. W. Lester, who is also treasurer of the Worcester Consolidated Street Railway Co.

The White City.

The cities of Chicago, Ill.; Cleveland, O.; Worcester, Mass.; New Haven, Conn., and Portland, Ore., have each an amusement park known as "The White City." These parks were all constructed and equipped by the Edward C. Boyce Co., 302 Broadway, New York City.

Of these parks, the White City at Chicago is probably the largest. It is reached by the lines of the Chicago City Ry., the Calumet Electric Street Ry. and the South Side Elevated R. R. Twenty-five hundred people per hour can be handled by these lines with ease. The park contains a number of amusement devices which include a scenic railroad, canals of Venice, shoot-the-chutes, fighting the flames, a midget city, baby incubators, circle swing, the bumps, a band stand and several smaller buildings.

A restaurant, which is known as the "College Inn," is contained in one of the largest and most imposing structures on the grounds and has accommodations for 2,400 people. A noticeable feature in connection with the buildings is the quality of material and the number of brick fire walls which insure safety and permanence of the structures. The sanitary arrangements are excellent and the park also includes a well-equipped fire department. The cost of constructing this amusement resort was over a million dollars and it is one of the finest and most complete of its kind in the country.

The Indiana Union Traction Co. has recently issued its new folder for the current year. It includes the time tables of the entire system and a handsome map of the company's lines. The feature of the folder which makes it particularly attractive is a lithographic cut of the Mounds Park, near Anderson, Ind.

The National Sash Lock.

Among the variety of car window sash locks which have been placed upon the market, the lock shown in the accompanying illustration presents some interesting features. The requisites of a good car window lock are that it permit the sash to be easily raised and when raised hold it securely in place. To those who are familiar with the average railway car window, which usually resists every effort to raise it and, when finally raised, is liable to suddenly fall again, the lock which we are describing should be of interest.

The illustration shows the method of operation very clearly. The lock contains two levers at the ends of which are teeth which fit into a rack fastened at the side of the sash. It is operated by simply compressing and releasing the levers and any jar which comes upon the window tends to lock it more securely. The sash

THE NATIONAL SASH LOCK.

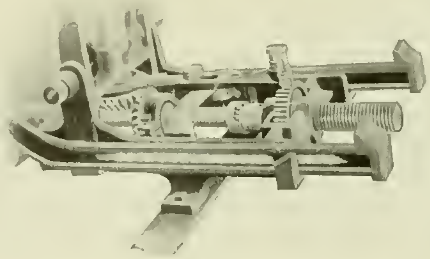
may be adjusted to any point in its slide and when so adjusted will remain securely fastened. The levers are so arranged that if the bottom lever is lifted, the top lever unlocks itself, but if the top lever is pulled down, it will not unlock the bottom lever, so that to lower the window the bottom lever must be used. If by any chance the spring should break, the bottom lever is free and will hold the window by gravity. It is claimed for this sash lock that it will automatically adjust itself to the swelling and shrinking of the wood. The lock is of simple design and has few working parts, these parts being strong and durable.

The lock is placed on the market by the National Lock Washer Co., 65-79 Johnson St., Newark, N. J.

Some New Track Tools.

There has very recently been placed on the market by the Cook's Railway Appliance Co., of Kalamazoo, Mich., a portable rail drill which has shown in tests that it is a very efficient tool. This drill, known as the "Premier," has the collapsible form similar to this company's "Standard" drill, but the detail design of the bit feeding mechanism has been changed. The thrust of the drill bit holder in the "Premier" drill is taken up by a ball bearing with the balls encased in hardened grooves and protected by dustproof caps. This method of absorbing the thrust pressure is said to eliminate a drill trouble commonly occasioned by the cutting of the thrust bearing. It is easily seen that with the friction at the thrust point thus greatly lessened, the same amount of power exerted on the handles of the drill will be used at the bit point in cutting through the rail and not be lost in the drill mechanism. The report of an actual test shows that with this tool a ⅞-in. hole may be drilled through an 80-lb. rail in 2 min. 4 sec. When especially heavy work is being done the point can be fed in at the fast feed and then slowed when the heavy cut is reached. In this way the "Premier" drill will drill holes up to 1⅜ in. in diameter.

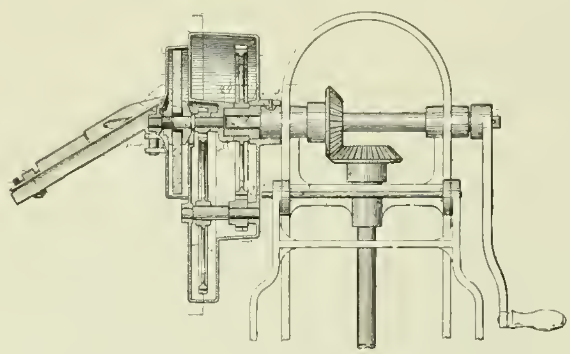
The feeding device for such a drill has been improved and made more positive in its action by means of an ingeniously designed slotted lever arm carrying at its ends a pawl which engages with the radially flat teeth of a ratchet on the main shaft of the drill. By proper adjustments of the parts of this attachment, the feed may be varied from fast to slow in the forward position or may be



FEEDING MECHANISM OF PREMIER DRILL.

reversed so that the drill will be extricated from the hole without breaking the point.

The accompanying illustration is a sectional view of Cook's Drill and Tool Grinder in its working position when attached to the ordinary portable drill frame in place of one of the crank handles. This device consists of a 6-in. emery wheel with its train of gears for driving from the portable drill handle shaft.



TOOL GRINDER AND BIT HOLDER ATTACHED TO COOK'S RAIL DRILL.

The gears and the emery wheel are encased in a malleable iron box with a suitable opening and a bracket rest for holding the tool to be ground against the side of the emery wheel. The high speed journals run in brass bushings and the bearings are internally oiled by means of tubes extending from the outer part of the shell.

Park Apparatus.

The Narragansett Machine Co., Providence, R. I., has recently issued the second edition of its catalog of playground apparatus in which it calls attention to the following specially desirable requirements in the design and manufacture of amusement devices.

The catalog points out that such apparatus is subjected to the severest use and abuse and must stand exposure to the weather under the worst possible conditions of heat and dust. The device should be simple enough to suggest its own use even to a child, should be safe in itself and so arranged that it will not collide or interfere with any other when in use. The device should also be compact and

the best possible use made of every square foot of land occupied.

The company has been engaged in the manufacture of these products for over ten years and the results obtained have been brought about by their long experience. The successful device suitable for an amusement park which this company manufactures, is its standard bowling alley. These alleys are built in the most substantial manner from the best material, are durable and present a pleasing appearance. The company also manufactures lockers of wood or steel which they furnish in any size and finish.

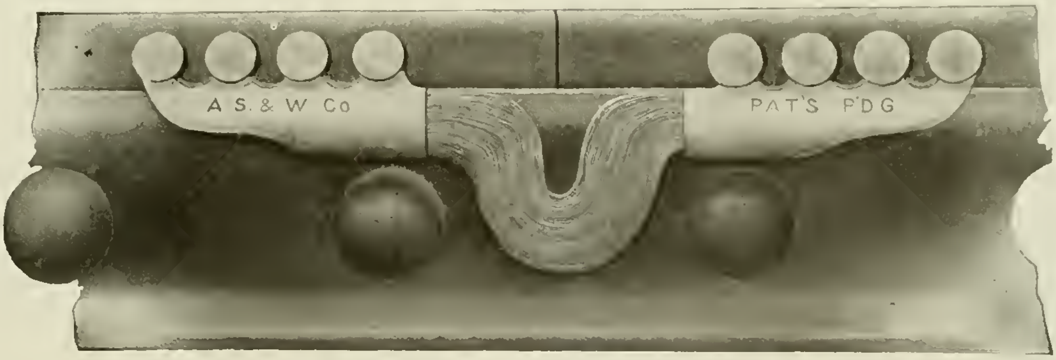
A Noiseless Brake Hanger.

A new form of brake hanger, which automatically tightens as the bearing parts are worn thus eliminating much objectionable noise often caused by loose hangers, has lately been put on the market by the J. G. Brill Co. It is known as the Brill noiseless brake hanger. Mr. G. Martin Brill, the inventor of this device, has experimented with such devices for some time and considers this hanger to meet the needs completely. The hanger has been in use on various roads since last July and has proved thoroughly satisfactory in each case.

By reference to the illustration it is seen that the device has few parts and takes up very little space. It consists of a hanger with a ball and socket joint at each end. The cap socket is always pressed firmly against the ball by a wedge-shaped casting and this casting is advanced and takes up the wear which is occasioned by the friction of the ball, by a pair of coil springs which are sufficiently long to insure the proper amount of pressure at all times. The wedge has a movement of $1\frac{1}{2}$ in. and according to the experience of various roads, the socket castings will last about two years. The wear of course is reduced by the fact that the parts are constantly held closely together. The parts are made of malleable casting, with the exception of the hanger, which is forged. In the illustration (1) represents the truck transom; (2), hanger holder; (3), wedge; (4), wedge adjusting spring, of which there are two; (5), upper socket; (6), lower socket, divided; (7), hanger; (8), brake beam.

NOISELESS BRAKE HANGER WITH AUTOMATIC TIGHTENER FOR TAKING UP WEAR.

The noiseless brake hanger is made for all sizes and styles of trucks, and besides the form illustrated, is arranged to connect directly with a special style of brake shoe holder for trucks which have inside-hung brakes and where space must be economized. The device will commend itself to practical railroad men, as it is self-adjusting and has no thread to work loose. It is now being used on a large number of trucks and was recently specified in an order of 100 trucks for an interurban railway in Ohio.



QUADRUPLE TERMINAL FLEXIBLE RAIL BOND FOR HEAVY WORK.

A Recent Design of Quadruple Terminal Bond.

Sometime ago we presented an illustration and description of the American Steel & Wire Co.'s new "Twin terminal" rail bond, which briefly described, has for its terminals two small studs driven into cup-shaped holes in the head of the rail. The principle of the bond has been found satisfactory and the company is also promoting the sale of a quadruple terminal rail bond, as illustrated. This bond is said to have the full current carrying capacity of a 100-lb. rail and a joint resistance of less than one foot of rail. Due to the ease with which it can be applied it is especially suited for rebonding existing track carrying a heavy current.

The manufacturer furnishes a special multiple-spindle drill for boring the holes in the lower outer edge of the ball of the rail into which the copper studs are firmly driven and locked. With this gang drill four suitable holes can be bored at once without interfering with traffic and disturbing the joint plates. The terminals may be set in the rail either with the customary compressor or by the use of a spike maul.

Delos Metals.

Among the several metal mixtures used for electrical work are the "Delos Metals," sold by the Elmer P. Morris Co., 51 Dey St., New York City. These special mixtures are well adapted for different uses.

The White Bronze metal compound is recommended for its wearing qualities when used in electric railway motors, trucks and journal bearings and such other places where bearings are required to withstand great pressure. Its crushing strength is claimed to be about the same as cast iron and it will not flow under a temperature of 1,200° F.

The Delos Bronze metal which is used in the construction of overhead material has a tensile strength of 64,000 lb. per sq. in. and bends under about the same stress as mild steel. It can be worked either hot or cold and can be cast in any form desired. The metal is a pure copper casting made in forms to meet various requirements. By a special chemical process it is made quite hard and when used for trolley wheels it is claimed that they will not wear the trolley wire. The makers guarantee this metal to be 98.98 per cent pure copper.

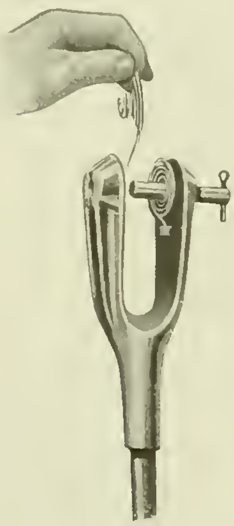
The Chicago & Milwaukee Electric Railroad Co. has leased offices in Racine, Wis., which will be occupied by civil engineers and superintendents of construction. Work on the line between Kenosha and Milwaukee is being pushed rapidly and it is expected that the portion to Racine will be completed by June next.

Capitalists at London, Windsor, Chatham and Sarnia, Ont., are considering the construction of an electric railway from Sarnia to London and a charter for this proposed company will be applied for at the next session of the legislature.

The Balance Spring Trolley Harp.

Many types of current collecting devices have been tried, but as yet the harp and wheel are standard, and any improvement in the design of the parts that will tend to increase the life of trolley wheels and bushings is indeed welcome. The records on different roads indicate that the life of wheels can be increased from 4,000 to 7,000 car miles, depending largely upon the kind of trolley support used and the tension of the trolley pole spring.

The United Copper Foundry Co., 11 High St., Boston, Mass., has recently placed on the market a harp which has shown its value in



BALANCE SPRING HARP AND BUSHING.

increasing the life of trolley wheels. The new device is known as the Balance Spring Harp. As is shown in the accompanying illustration, this harp is provided with a flexible contact-spring washer on either side of the wheel, which assures a continuous contact. By thus relieving the bushing of carrying a heavy current, the life of the wheel is prolonged. The spring, which is composed of a special metal made by the company, is so arranged that it permits both lateral and vertical motions with the vibrations of the wheel, thus reducing the jar on the bushing and as the spring is at all times in gentle contact with the sides of the trolley wheel it prevents the usual wear between the wheel and the harp. The spring also carries a quantity of oil in its coils, thus assuring thorough lubrication.

The cars of several eastern roads have been fitted with this improved spring harp and satisfactory results have been obtained under severe conditions.

Ramona Park.

ST. LOUIS & SUBURBAN RAILWAY CO.

Ramona Park is served by the St. Louis & Suburban Railway Co. and is controlled and managed by J. L. Goss, independently of that company. The park is located about four miles from the city limits of St. Louis. It includes about 60 acres of land and contains a lake covering seven acres.

The park includes the usual amusements operated at such resorts. The lake affords good fishing and boating facilities and there are also a good restaurant and a large dancing pavilion. These features, together with the other privileges, including the merry-go-round, shooting galleries, etc., are leased each season. The park is a popular picnic ground and is largely patronized by the various fraternal orders, schools and societies of St. Louis.

Pine Grove Park.

CLAREMONT RAILWAY & LIGHTING CO.

Pine Grove Park is located on the line of the Claremont Railway & Lighting Co. two and a half miles from the town of Claremont, N. H. It is operated and managed by its owners, M. H., S. J., and Geo. E. Moody. There is no theater included in the concessions, but a place is provided in the pavilion for vaudeville performances and a large theater is contemplated in the near future. A large skating rink will also be built.

The dancing pavilion has a floor 40 x 60 ft. in size and contains a cafe and lunch counter. There are also a shooting gallery, a merry-go-round, box ball alleys and a good baseball diamond. The natural beauty of the scenery in this portion of New Hampshire has left little to be done in the way of artificial additions, but enough care has been expended upon the grounds to make them very attractive from an artificial as well as a natural standpoint.

The Circle Swing.

In view of the increasing popularity and the already extended use of the circle swing in amusement parks, we are presenting a description of a type of swing which is being placed on the market by the North Penn Iron Co., Philadelphia, Pa.

The structural parts are of steel, heavily proportioned to give ample stability and the entire frame work is galvanized to prevent rust. The cars are constructed in imitation of air-ships, the seats being well upholstered. The fringed canopy top is of heavy canvas covered with netting like a balloon and the entire car is finished in maroon and silver. A polished brass propeller is attached to the rear and revolves as the car moves through the air, which increases the resemblance to an air-ship. Each car is supported by four steel cables, the ultimate strength of which is considerably greater than necessity demands. The company is planning many improvements to its plants now under construction.

Each machine is built with a view to the absolute safety of its patrons. The company claims that so far not a single case of accident to the machines manufactured by it has been reported. It is also stated that the average receipts from these swings during the seasons of 1904 and 1905 show that the earning capacity of the circle swing is, in proportion to its cost, as great as any other amusement device on the market.

This device has a number of pleasing features. The novelty of being carried through the air at great speed without the slightest jar or jolt is much enjoyed by the amusement-loving public. Its advertising qualities are also good, as the multi-colored flags, fluttering from the cables produce a beautiful effect by day. At night 500 colored incandescent lamps are lit, forming a six-pointed star which gradually opens and closes and presents a display that may be seen from a great distance.

New Pleasure Park for San Antonia, Tex.

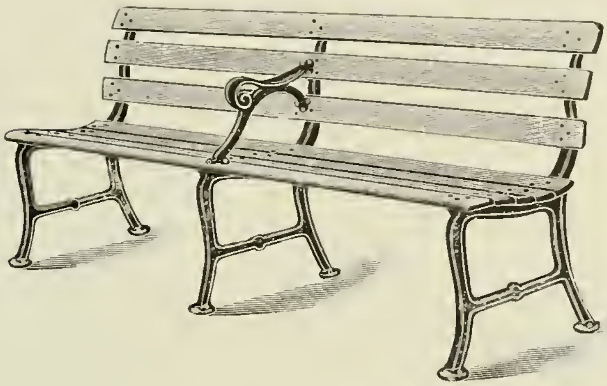
A new pleasure park and summer theater is to be built at San Antonio, Tex., by Mr. Sidney H. Weis. Plans have been prepared for this new resort, which will be known as the New Electric Park, and preliminary arrangements are being made for the construction work, which will be commenced in time for completion early next summer. Among the many amusement devices that will be installed will be a roller coaster, dancing pavilion, bump the bumps, skating rink, Mexican village and shoot-the-chutes. These will be installed along the north side of the park, while on the opposite side it is expected to install a carrousal, picture machine, house of troubles, penny arcade, museum, restaurant, zoological gardens and summer theater. Opposite the entrance and at the extreme end of the park an electric tower will be erected and a beautifully illuminated electric fountain will be placed in the lagoon opposite the chutes. Two beautiful streams will run through the ground from north to south. The ground to be occupied by this park is 1,000 ft. deep with a frontage of 335 ft. on Nixon St., and 500 ft. on North Flores St. The property has already been purchased and work has been commenced for putting the ground in preparation for the new buildings, concessions and various amusements. The date set for the opening of this resort is April 1, 1906.

Throughout this number of the "Street Railway Review" are many park descriptions, and by reference it will be noted that special displays of fireworks have proved to be good attractions. B. E. Gregory, 167 Dearborn St., Chicago, Ill., is a specialist in furnishing pyrotechnical displays which are suitable for park attractions. For those desiring to give two displays a week, extending over a season of six or ten weeks, Mr. Gregory furnishes at a nominal charge an expert capable of directing the exhibitions and making such special pieces and designs as would be suitable for the time and place.

The Chicago Park Bench.

With the opening of the park season but a few months away, park managers will be turning their attention to the repair and replacement of their park equipment and, at this time, a presentation of the park settee, which we here illustrate, may not be out of place. The bench is placed on the market by the E. H. Stafford Manufacturing Co., Chicago, Ill., and is already in use in a number of parks.

It is made from eight one-inch maple slats attached to irons by 20 bolts, ¼ in. in diameter, placed at each standard. The castings are made from new iron and have a black japanned finish, which is



THE CHICAGO SETTEE.

baked on. The slats have rounded edges and a hard-oil finish. The feet of the standards are drilled for screws with which to fasten the bench to the ground. The bench is furnished in lengths from four to seven feet and arms may be ordered as desired. The company also makes a folding settee in any length up to 12 ft.

The White City.

FT. WORTH & ROSEN HEIGHTS STREET RAILWAY CO.

The White City is situated at Rosen Heights, about three miles from the city of Ft. Worth, Tex., and is owned and operated by the Rosen Heights Amusement Co. It is a five-cent fare on the lines of the Ft. Worth & Rosen Heights Street Railway Co. and draws its patronage from a population of nearly 100,000 people. The park includes a theater with a seating capacity of 1,000 and plays dramatic and operatic productions. There is also a large lake, a dancing pavilion that will accommodate 100 couples and a skating rink. Other amusement features are operated, including a miniature railway, a figure-eight toboggan, an aerial swing, a Ferris wheel, a "Katzenjammer Castle," a trip to the Alps and an old mill.

Gee Whiz.

The above peculiar expression is the name of a new and popular attraction which the Amusement Contracting Co., Philadelphia, Pa., is introducing in a number of amusement parks.

The machine consists of four steel arms which radiate from a central revolving table at an angle of about 45° with the horizontal, each arm carrying a cab accommodating four passengers. The best materials are used in the construction of this device and the mechanical parts are very simple. The steel arms carrying the cabs are made sufficiently strong to carry many times the load placed upon them. The cabs are of ornamental design and finished in panel work. An electric motor of about seven horse power capacity furnishes the motive power. The plant occupies a space 50 ft. in diameter, enclosed by a circular fence.

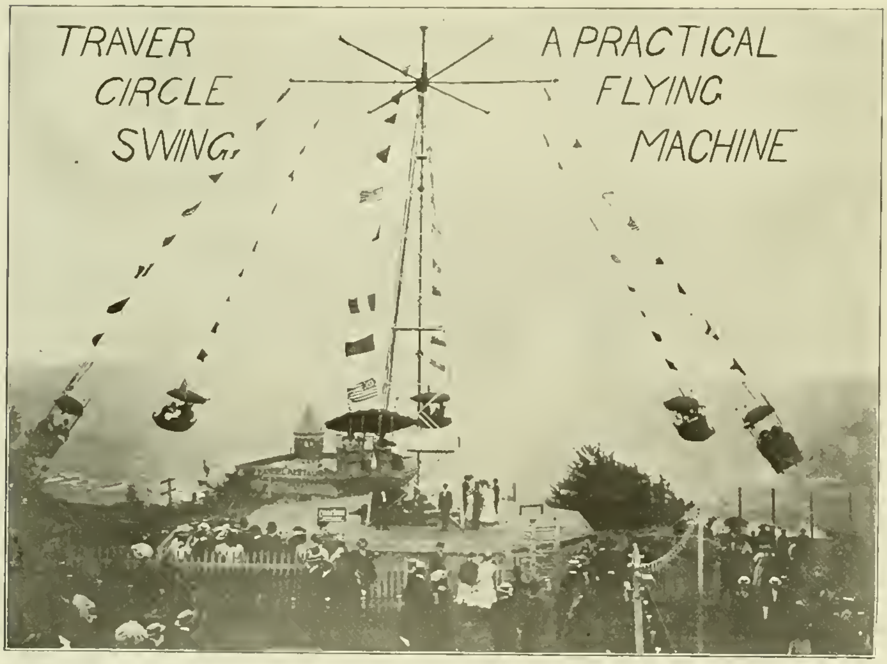
The four cabs make 20 trips per hour and with a five-cent fare and four passengers to a cab, the machine has an earning capacity of $16 per hour. The expense of maintenance and operation is about 57 cents per hour. A ticket seller and two attendants are all that are required to operate the machine.

The Circle Swing for Parks.

Among the numerous amusement devices operated in the various pleasure resorts of the country few enjoy wider popularity and give greater satisfaction than the "Circle Swing Flying Machine," or "airships," as they are generally called. The chief attraction of these devices is the pleasant effect produced by the rapid motion through the air. A very attractive type of this apparatus, which we illustrate herewith, is placed upon the market by the Traver Circle Swing Co., New York City It was first brought out in the season of 1903, and since that time sixty-eight have been built in many of the principal resorts of the country.

The cars are suspended, as shown, from strongly supported arms at the top of the tower by ½-in. steel cables. These arms are attached to a solid steel shaft which runs to the base of the swing where the bottom of it turns in a step bearing. The structure is steel throughout and a factor of safety of 20 was maintained in designing all parts of the machine. The steel parts of the plant are galvanized so as to prevent rust. The cars are built in capacities up to twelve persons each. The seats are made of rattan stiffened with iron and upholstered with reed-work over a frame well supplied with springs.

The operation of the circle swing is said to be noiseless and



THE TRAVER CIRCLE SWING.

without vibration. The cars start from the ground level and are gradually moved faster and faster, increasing the speed and the diameter until they have attained their greatest height. Then the power is slowly reduced and the car gently lowered to the ground. The speed regulation is secured by an electric controller governing all the machinery in operation.

The company has installed swings at Paragon Park, Nantasket Beach, Boston, Mass.; the White City, Chicago, Ill.; Elitch Gardens, Denver, Col.; the Chutes, San Francisco, Cal.; Forest Park Highlands, St. Louis, Mo., and Paradise Park, Ft. George, New York.

Out of the Cold.

Special low rates to the winter resorts of the South are now available. W. A. Beckler, northern passenger agent of the Queen & Crescent route, whose office is at 113 Monroe St., Chicago, Ill., advises that winter tourist tickets with generous stopover privileges and long time limits are now on sale and that on receipt of notice, he will be pleased to forward interesting illustrated booklets and particulars regarding the various trips offered. A special rate of $69 for the trip from Chicago to Havana, Cuba and return, with stopovers permitting visits at the Florida winter resorts, is now offered. The Gulf steamers of this line make six sailings each week between Florida points and Cuba.

The Increasing Popularity of Roller Skates.

The use of roller-skating rinks as park attractions is fast becoming general and the Samuel Winslow Skate Manufacturing Co. of Worcester, Mass., advises that large orders for roller skates, to be supplied for the 1906 season, foretell the return of the roller-skating fad. This company has manufactured skates of all kinds since 1873 and is therefore a pioneer in its line. With this experience, extending over a period of nearly 35 years, it has been possible to greatly perfect the methods and products of its plants. There are now being manufactured many patterns of skates, each one of which is said to be adapted to the particular use for which it is designed. The qualities of strength, durability and symmetry are prominent in these products.

The Ocean Shore Railway.

The electric line which the Ocean Shore Railway Co. has under construction will extend from San Francisco to Santa Cruz, a distance of 82 miles. The road will be double-tracked throughout its entire length. Its train service will be handled by 43 GE-66 four-motor equipments with type M control. It is said that these units will be capable of a maximum speed of 60 m. p. h. The catenary type of line construction will be used with a direct current line pressure of 600 volts.

The power house will be located at Balboa and will contain two three-phase, 2,000-kw., 2,300-volt, 25-cycle, flywheel type generators driven by vertical cross-compound engines at a speed of 107 r. p. m. The output of these generators will be stepped up from 2,200 to 33,000 volts, the line pressure by seven 1,000-kw., water-cooled transformers. The exciting current will be furnished by one 90-kw. capacity, induction motor driven exciter and on 125-kw. engine-driven exciter. There will be 10 sub-stations, each containing one 500-kw., six-phase, 600-volt rotary converter with the necessary auxiliary apparatus. Eight of these sub-stations will be permanently located along the line, one will be installed in the generating station and two will be of the portable type mounted on cars which can be shifted as required to take care of the exceptional load conditions. The electrical equipconditions. The electrical equipment will be furnished by the General Electric Co.

The Herschell, Spillman Co.

The Herschell, Spillman Co., North Tonawanda, N. Y., has recently purchased the plant and assets of the Armitage-Herschell Co., of that city. This means the combining of two large factories which have, in years past, supplied a great part of the many riding galleries, ocean-wave galleries, miniature railways and other attractions that have been placed in many outdoor amusement resorts. Both plants will be operated by the Herschell, Spillman Co., and the combined floor space will be more than 100,000 sq. ft.

The president of the Herschell, Spillman Co., Allan Herschell, has been engaged in operating and manufacturing amusement devices for 23 years, and the heads of the different departments of this company are thoroughly trained in their respective lines of work. This combination of men, space and machinery will enable the giving of more careful attention to all orders.

A movement is on foot to secure street railway cars for the collection of mail in Denver.

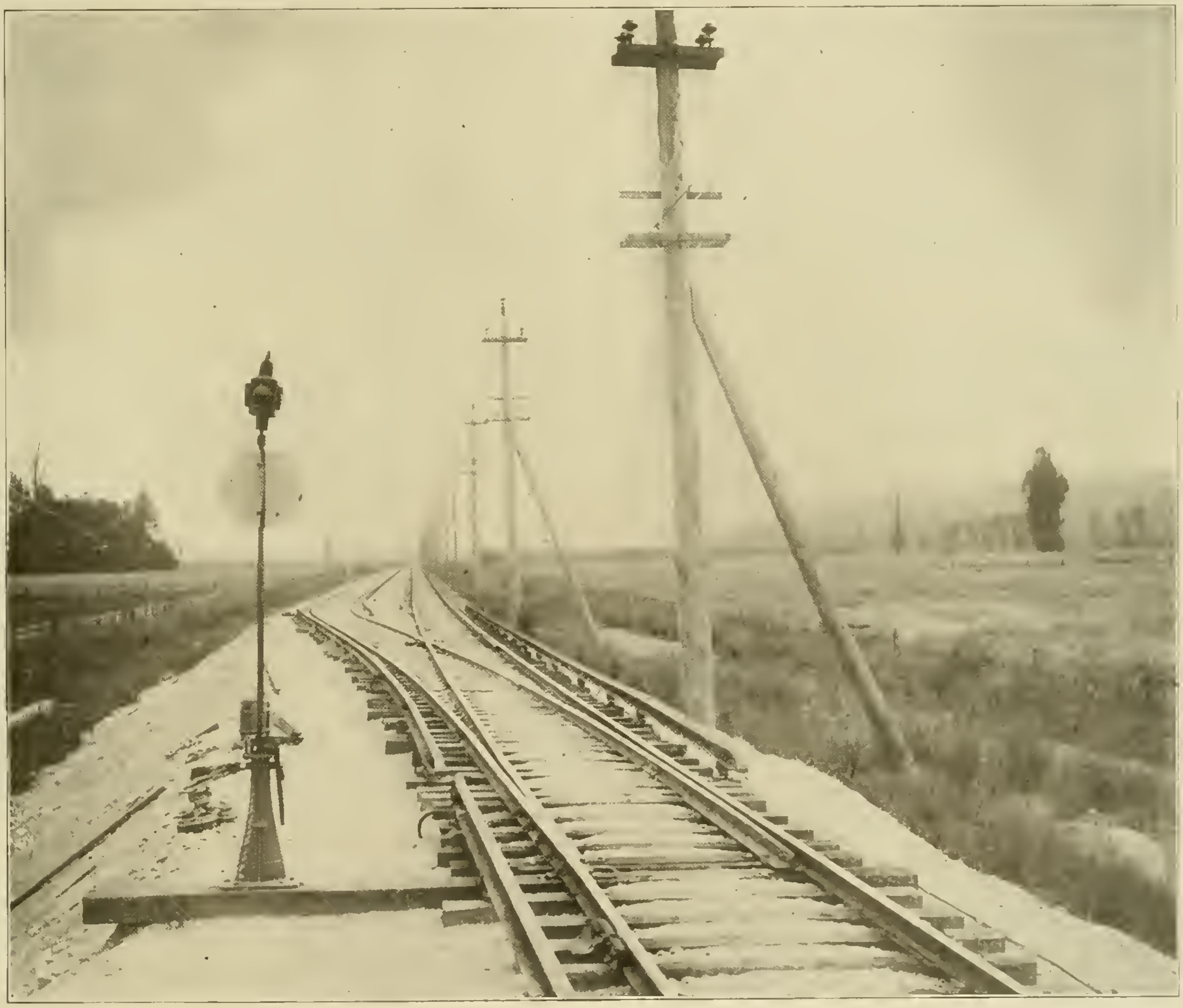
STREET RAILWAY REVIEW

Vol. XVI | MARCH 15, 1906 | No. 3

The Puget Sound Electric Railway.

Being an Extended Description of Its Physical Features, Equipment, Passenger and Freight Traffic, Operating System and Accounting.

In the extreme northwestern part of the United States there is a portion of the State of Washington which attracts the attention of the American public because of its favorable climate and the marvelous growth of its importing and exporting trade. This increase has been especially rapid during the past 15 years, the trading in 1905 amounting to over $35,000,000. This attractive region is known as the "Puget Sound District." Its two chief cities and sea-ports are Seattle and Tacoma. Seattle, the great business rival of San Francisco, is favored with the trade from Alaska and the Klondike and has a population of 170,000. Tacoma, although a smaller city, handles more commerce, both in imports and exports, than either Seattle or Portland, Ore., and is situated 36 miles south of Seattle. Tacoma has a population of 85,000.



TRACK SCENE AT SIDING BETWEEN KENT AND TACOMA.—PUGET SOUND ELECTRIC RY.

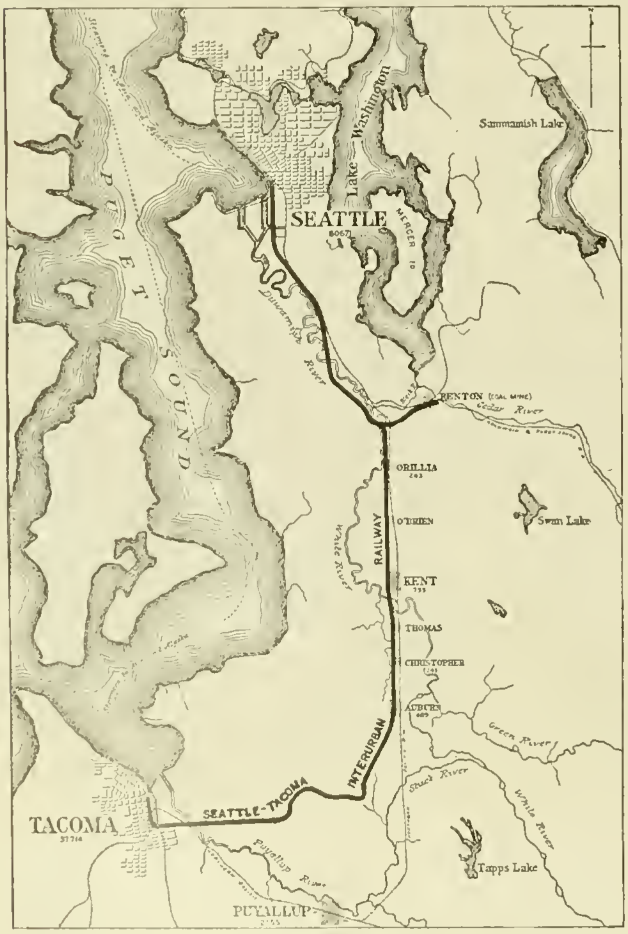
These attractive cities are connected by the Puget Sound Electric Ry., with its tracks paralleling the Northern Pacific Ry. for a greater part of the distance. As the electrical equipment is capable of high speeds, it is interesting to passengers to see the electric trains overtake and pass the fast "North Coast Limited" of the steam railroad.

On the route between Seattle and Tacoma are the cities of Georgetown, 4,000, Renton, 2,000, Kent, 2,500, Auburn, 1,200 and a large number of smaller towns. The road passes through the "Puyallup", "White River" and "Stuck" valleys which are the most productive of any in the state and serve as feeders of produce, milk, cattle, etc., for a large portion of the freight business of this well-equipped railway.

TERMINAL STATION AT TACOMA.

Track Construcion.

As the equipment and traffic are of an exceptionally heavy class and transport a large amount of carload freight consisting of coal from the company's mines at Renton and logs from its sawmill at Milton, a substantial type of track and roadbed was built. Many of the trains are operated at high speeds and the track therefore is maintained in a thorough manner. The general route of the line is from the water front at Seattle nearly south to a point from where the line extends westward into Tacoma. As will be noted from the illustrations, the general lay of the land through which this roadbed has been built is quite rough, but the construction is thorough and the track is of such design as will permit of high-speed operation. In Tacoma and Seattle there are few grades while on the route between the two cities there are grades varying from 1½ to 2 per cent. Eighty-four per cent of the track between Tacoma and Seattle is constructed on tangents and 75 per cent of the curves have a radius of 573.7 ft. (10 degrees) or more.



MAP OF THE PUGET SOUND DISTRICT SHOWING THE ROUTE OF THE INTERURBAN.

The track is of standard construction with 70-lb. rails in 30-ft. lengths laid on fir ties of standard dimensions. The entire line, which is 36.5 miles in length, is ballasted with 15 inches of gravel, and since the road was first opened, Oct. 5, 1902, the roadbed has needed no resurfacing. Power is distributed to the rolling stock through a working conductor consisting of a 100-lb. third-rail and auxiliary cables.

There are two grade crossings with steam railroads, one in Seattle and one in Tacoma. Each is protected by gates and a flagman. The country road crossings are well guarded on account of the presence of the third-rail. At all road intersections warning signs are displayed cautioning against trespassing upon the right of way.

Transmission Lines.

Current for the operation of the line is supplied by the Puget Sound Power Co. from its water power generating station at Electron, Wash. This station, as described and illustrated in the "Street Railway Review" for Sept. 20, 1904, has an installed capacity of 20,000 h. p. with an ultimate capacity of 40,000 h. p.

Three-phase current is generated at 2,300 volts, and is stepped up to 55,000 volts for transmission. From the power house two parallel transmission lines extend for a distance of 22 miles to Bluffs, a station on the line 9 miles from Tacoma and 25 miles from Seattle. From Bluffs one line parallels the tracks of the interurban for the greater part of the distance to Seattle, and one line extends to Tacoma, also paralleling the electric railway tracks. There is also a second transmission line paralleling the track between Seattle and Tacoma now operated at 27,000 volts, but designed for operation at double this pressure. This latter transmission line is at present used exclusively for distributing power to the three sub-stations at Milton, Kent, and Georgetown, respectively 6.59, 19.63 and 32.53 miles from Tacoma, the circuit being looped through each sub-station. Both the 55,000 and 27,000-volt lines enter the receiving stations at Seattle and Tacoma.

In the original transmission scheme high-tension current was

received at the Kent sub-station and distributed to the Milton and Georgetown sub-stations. At these sub-stations the arrangement of the high-tension switches permitted the line being cut through from the Tacoma station to the Seattle station. At

PASSENGER AND FREIGHT STATION AT KENT.

present current is received at the Tacoma receiving station of the Tacoma Railway & Power Co. at 50,000 volts and delivered to the three sub-stations at 27,000 volts. Two 500-kw., 2,300 to 27,000-volt transformers at Seattle furnish a relay in case of failure of the transformers in Tacoma. When the 27,000-volt line is changed to carry 55,000 volts pressure, there will be two independent transmission lines from the power house at Electron to Bluffs, and from Bluffs to Tacoma and Seattle.

Sub-Stations.

As previously stated there are three sub-stations located respectively at Milton, Kent and Georgetown. Each sub-station consists of a brick generator and transformer building 25x40 ft. in size, and a wooden battery room 51x52½ ft. in size. A brick fireproof wall separates the transformer and generator rooms. The original equipment of each consists of two 180-kw., oil-cooled transformers which step down the three-phase current from 27,000 volts to 2,200 and 110 volts, a spare transformer being installed in the Kent sub-station. Recently 200-kw., 50,000 and 25,000 to 2,300-volt, oil-cooled transformers have been substituted for the original transformers in the three sub-stations, this change being necessitated by the proposed increase of line voltage from 25,000 to 50,000 volts. There is also in each sub-station one 300-kw., G. E., induction motor generator set consisting of a 450-h. p., 2,200-volt, two-phase induction motor and a 300-kw., 600-volt, direct-current generator. Each storage battery has 288 type "G" chloride accumulator cells with a one-hour discharge rate of 640 amperes. Each battery has in connection with it a differential-wound booster.

A 100-lb. third-rail is used, supported on reconstructed granite insulators, one insulator to every fifth tie, the center line being at a distance of 20 in. from the gage line of the track rail, and having a top surface 6⅞ in. above the top of the track rail The third-rail extends from the Race Track, 4.25 miles from the city limits of Seattle, to the city limits of Tacoma, a total distance of 28.15 miles. Overhead trolley is used from the Race Track to the city limits of Seattle and within the city limits of Seattle and the city limits of Tacoma. In order to make the cross-section of the conductor uniform throughout, two 500,000-c. m. feeders supplement the trolley and trolley feeders from the end of the third-rail to the Georgetown sub-station. There is also a 300,000-c. m. feeder extending from the Georgetown sub-station to the Milton sub-station.

Passenger Traffic.

The passenger service between Tacoma and Seattle includes 34 trains a day, a train of two or three cars leaving every hour from either end of the line. Four of the trains run on a limited schedule, making no stops between the two cities. The total distance of 36 miles is covered in 1 hr. 15 min. The terminals of the route are at

SUB-STATION AND CAR HOUSES AT KENT.

the center of the business portions of the two cities and here transfers are given over local lines to all points within the limits of either city. In Seattle, there are 1.64 miles of track over which trains must operate at a slow speed and a similar condition exists in operating over 2.36 miles of the route in Tacoma. In the schedules, 15

minutes' time is allowed for running this four miles of track within the limits of the two cities, thus leaving 32 miles which must be run in 45 minutes in order to maintain the established schedule time.

From a junction point, 12 miles south of Seattle, there is a branch

BIRDS-EYE VIEW OF THE CITY OF TACOMA, A TERMINAL OF THE PUGET SOUND

2.2 miles long, serving the town of Renton. On this branch line, an hourly service with 33 trains a day is operated. This service combined with that of the through line makes a total of 67 passenger trains a day operating on 44.8 miles of single track.

The rolling stock for the main line passenger service consists of 7 combination passenger and baggage coaches and 8 trailers. For the Renton branch 3 motor cars and 2 trailers. These passenger equipments were built by the J. G. Brill and the John Stevenson companies. The main line passenger cars are 43 ft. long over bumpers and 9 ft. wide over all. The motor cars weigh 42 tons each when empty, and have a seating capacity of 42 passengers. The interiors are handsomely finished in mahogany and have seats of the "walk-over" type, upholstered in green plush in the trail cars and rattan in the motor cars. The interior arrangement is similar to that of a standard railroad coach. The cars are pro-

STANDARD PASSENGER AND FREIGHT DEPOT AT WAY STATIONS.

vided with lavatories and are heated by electricity. The motive power equipment consists of four GE-66 motors on each car with type-M multiple-unit control. The trucks are of the Brill 27-E type with 33-in. steel wheels and 6-in. axles. All cars are fitted with a Westinghouse automatic air-brake equipment and hand brakes.

The motor cars for the Renton branch are 42 ft. long and 8 ft. 6 in. wide. Their interior finish is mahogany and their seating capacity is sufficient for 44 passengers. Each car is equipped with four GE-57 motors and two K-14 controllers. The trail cars for this branch are of the same type. Each train consists of one motor and one trailer.

Freight Traffic.

The Puget Sound Electric Ry. has given much attention to building up its freight business against very strong competition by water and rail. The results illustrate what can be done by an active freight campaign and show that 10,131 cars of freight were handled during the year 1905. This does not include express and less than carload lot freight, which traffic has grown to large proportions. Owing to the excellent service given this class of freight, merchants in Seattle and Tacoma have realized that it is to their advantage to patronize the electric lines entirely. These advantages also apply to the farmers and market gardeners between Seattle and Tacoma who make nearly all of their shipments of vegetables and fruit over the electric lines.

At Tacoma and Seattle there are large packing house plants. Three to five cars of fresh meat are handled daily to and from these points. The refrigerator cars used for this traffic are built with all the more recent improvements for handling fresh meat. Special tracks are hung from the car roofs so that meat can be run directly

FREIGHT DEPOT AT SEATTLE.

from the packing house into the car and from the cars back into the packing house.

The company's sawmill, which is located at Milton seven miles from Tacoma, has a capacity of 50,000 ft. per day. The timber is brought down to the mill on a logging spur seven miles long. This branch is operated with steam locomotives. The output of the mill is sold in Tacoma and Seattle and the handling of this carload traffic adds materially to the freight traffic. Coal mines owned by Stone & Webster are located at Renton. The coal is carried over

the electric line and sold at its terminal cities. The freight traffic also includes the handling of the outputs of the Renton Clay Co., the Seattle Glass Co., a large stone quarry, the Denny Clay Co. and the interchange of outputs between the packing houses in Seattle and

ELECTRIC RY.—THE TERMINAL BUILDING IS NEAR THE TOWER AT THE LEFT.

Tacoma. An express milk train operating between the two terminal cities, handles about 5,000 gallons of milk daily.

There are two freight trains each way between the terminal cities. All carload freight is handled at night and the express matter is handled during the day. The freight equipment consists of 2 freight locomotives; 2 express cars each equipped with four GE-66 motors and type-M multiple-unit control; 65 flat cars, 25 coal hoppers, 15 box cars, 14 gondolas and 5 refrigerator cars. All the freight cars are M. C. B. standard with brakes hung from the trucks and are equipped with automatic air and tower couplers, thus permitting the cars to be interchanged with the steam lines. Such an interchange of traffic brings to the electric road many carload shipments which are distributed to points on its lines. One operating feature of importance to the merchants and business men of Seattle and Tacoma is the interchange of traffic between the Seattle Electric Co.'s lines in Seattle and the Tacoma Railway & Power Co.'s lines in Tacoma. As the tracks of the three companies are of standard gage, cars can be switched to any point where the city systems have sidings and yard facilities for handling carload shipments.

BAGGAGE AND EXPRESS MOTOR CAR WITH TRAILERS.

System of Operating.

The operating department is conducted upon about the same lines as those of single-track, steam railways and has for its code the standard rules and regulations, formulated by the General Superintendents' Association of American Steam Railroads. This code is in general use throughout the country.

The question might possibly arise as to why the Puget Sound Electric Ry. is operated upon this system when it is an electric road connecting but two cities. In answer to this it may be stated that it has 44 miles of single track, 67 first-class passenger trains a day, to say nothing of specials, freights, work and express trains and is operating at a speed of from 45 to 60 miles per hour; there are 23 stations which are not regular meeting points, but which are used to assist trains falling late, and irregular trains, in making up time. This cannot be done except by telegraph or telephone, of which the former is considered the most reliable.

For movements of trains not provided for by the time table, train orders are issued by the authority and over the signature of the superintendent. They must contain neither information nor instructions not essential to such movements. They must be brief and clear in the prescribed forms when applicable, and without erasure, alteration or interlineation. Each train order must be given in the same words to all trains or persons directly affected. Train orders must be given each day, begining with No. 1 at midnight.

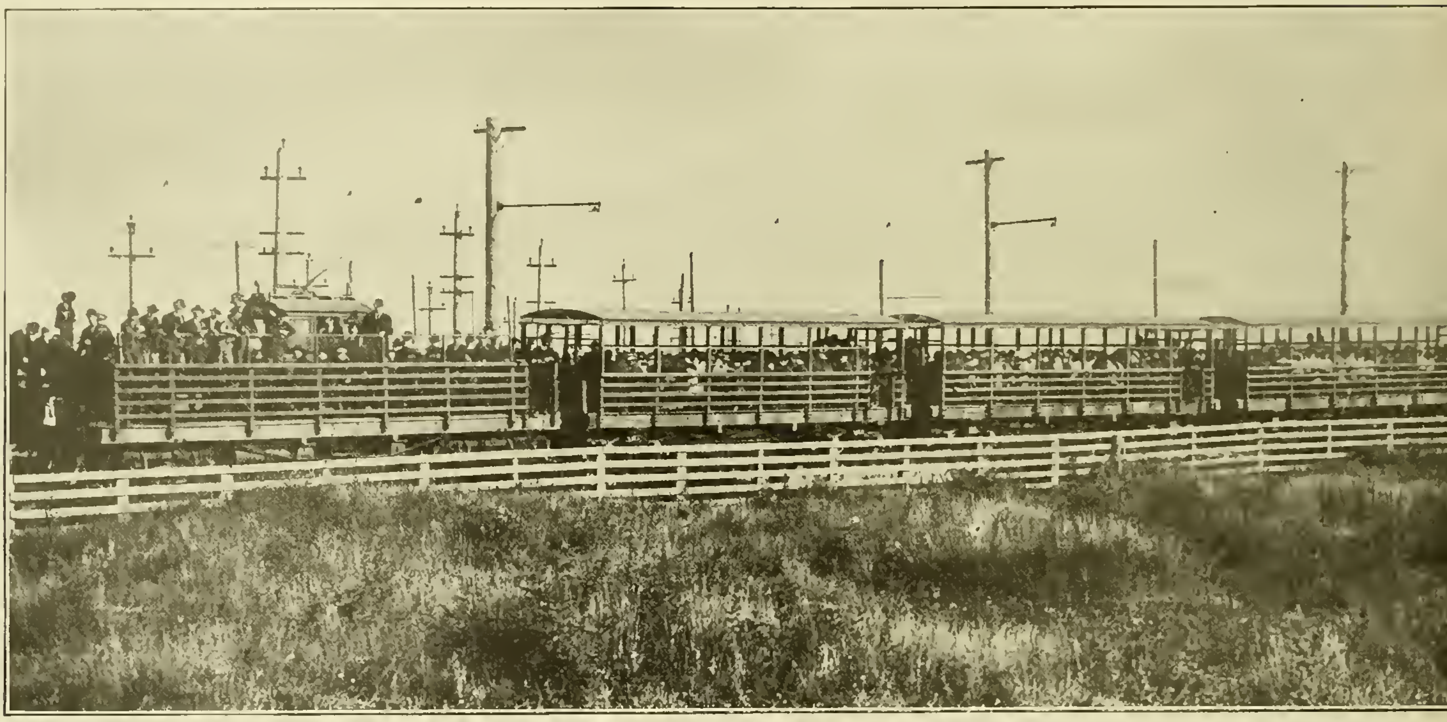
RAILWAY COMPANY'S SAWMILL AT MILTON.

All trains orders are written on the standard forms Nos. 19 and 31X and the clearance card, which is illustrated. Form No. 31 is used for orders restricting the rights of trains. Form No. 19 may be used for orders assisting trains of an inferior class or making meeting points between trains, in which case they are also sent to the operator at the meeting point in addition to being sent to each train

at some preceding office. The clearance card is used to designate the number of the "19" or "31" orders that are held by the operator for delivery, and cannot be delivered by him to the train addressed until he has asked and received from the train dispatcher a clearance of this form.

required to pass an examination upon the use of the automatic and straight air equipments.

Conductors and trainmen are uniformed according to specifications indicated by the management, and their appearance is regularly inspected. As much care is exercised in the employment of men



MAKING GOOD USE OF A LARGE NUMBER OF FLAT CARS AS A

Train orders must be addressed to those who are to execute them, naming the place at which each is to receive his copy. Those for a train must be addressed to the conductor and motorman, and also to anyone who acts as pilot. A copy for each person addressed must be supplied by the operator and a rule adopted by this company, which is probably in force on but few roads, is to furnish a copy of these orders to the trainmen for the additional safety of the train. The conductor has charge of the train and receives and signs for all train orders and, upon delivering the motorman his copy before the starting of the train from a station, the motorman is required to read it aloud in the presence of the conductor, as both

LONG TRESTLE AT RENTON.

motorman and conductor are held equally responsible for the safety of the train.

Conductors, motormen, trainmen, agents, and dispatchers are required to pass an examination of 100 per cent upon the rules pertaining to the transportation department at the beginning of their service and once every six months thereafter. Motormen, conductors and trainmen are required to pass a prescribed examination before the company's physician for vision, color perception, hearing, and physical condition at the time of employment. Motormen are

with good temperaments as is used in inquiring into their capabilities of handling passengers and trains.

A time inspector examines the watches of the conductors and motormen once every two weeks, marking upon a card held by the employe the condition of the watch. The employe signs a sheet record when his watch is checked, which is sent to the trainmaster's office who in turn checks up those who fail to have their watches attended to at the proper time. At the end of six months a general examination is made, and a new certificate issued for all watches passing the mark. The time inspector also regulates the station and standard clocks.

Sixty-seven first-class passenger trains are operated daily on a printed time table. This does not include irregular trains such as specials, freights, work and express trains having no rights other than those conferred upon them by train orders. The passing of all trains, regular and irregular, is recorded upon a dispatcher's sheet, showing the train number, motor car number and cars, and the motormen's and conductors' names. The causes of all delays longer than five minutes are reported by the conductor and recorded by the dispatcher under the head of "Remarks" at the bottom of the train sheet. After twelve o'clock, midnight, a report is made to the manager, superintendent, chief engineer, superintendent of power and the master mechanic, showing delays to trains by reason of track defects, power failures, motor failures, weather condition, accidents, etc., during the previous twenty-four hours.

The following are the various forms of train orders in use:

Form A: No. 1 will meet No. 2 at Kent.

Form B: Extra 501, north, will run ahead of No. 64, Kent to Orillia.

Form C: Extra 552, south, has right over No. 3, Milton to Tacoma.

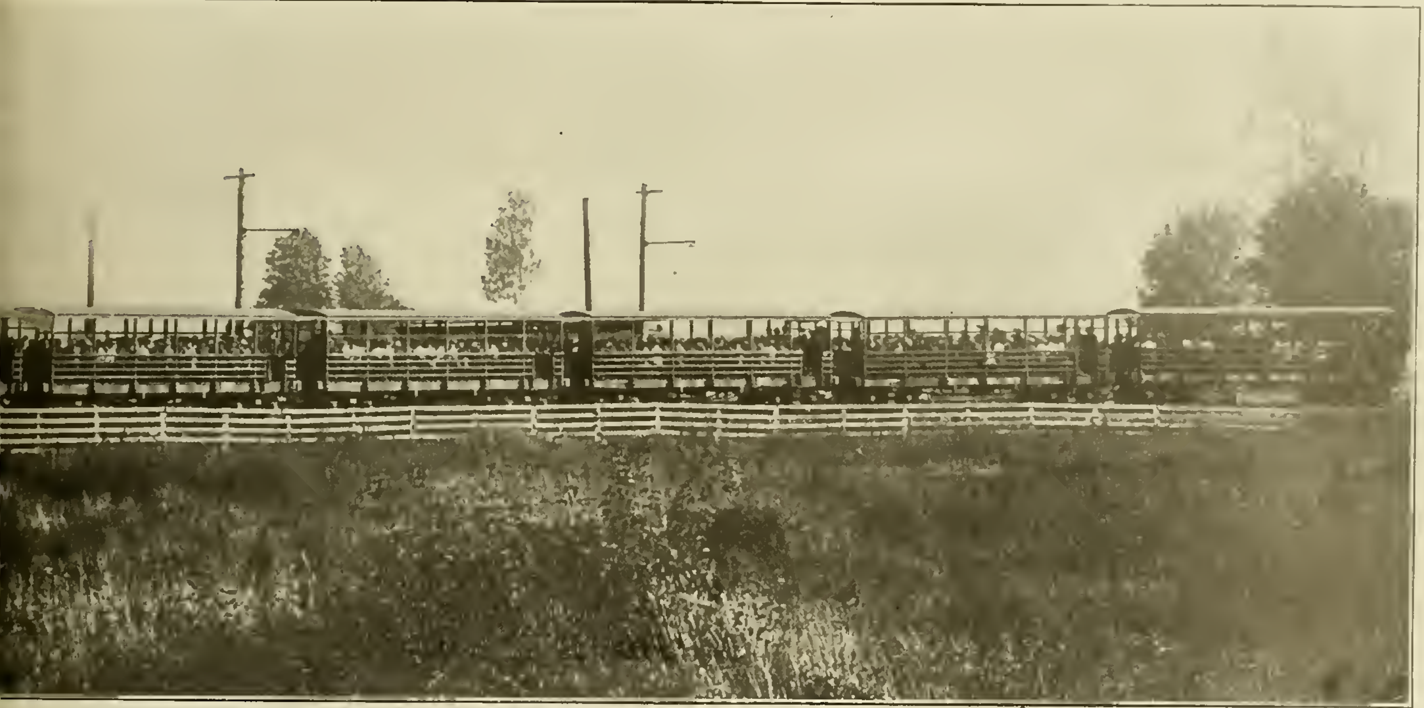
Form D: Regular trains have right over No. 57, Georgetown to Seattle.

Form E: No. 25 will run twenty minutes late, Riverton to Edgewood.

Form F: No. 52 will carry signals, Tacoma to Seattle, for motor 506.

Form G: Motor 500 will run extra, Seattle to Renton, on Sunday, February 17th, as follows, with right over all trains:

Leave	Seattle	9:00 a. m.
	Argo	9:10 a. m.
	Davis	9:20 a. m.
	Renton Jct.	9:30 a. m.
Ar.	Renton	9:35 a. m.



ECIAL TRAIN FOR HANDLING THE CROWDS ATTENDING THE RACES.

Form H: Motor 503 will run extra, Tacoma to Milton.

Form K: No. 57, of Sunday, February 17th, is annulled, Tacoma to Seattle.

Form S: Extra 508, north, has right over Extra 507, south, Tacoma to Kent. Waits at Wapato until 12:10 p. m. and at Bluffs until 12:30 p. m. for Extra 507.

For example, should it become necessary to send out a special train which is not designated on the time card, Form H would be used, and this train would clear the time of all schedule trains between the points mentioned in the order, and can go no farther than the limits mentioned. Should it also be necessary to send an additional train out on the road, which is not indicated on the time card, runing in an opposing direction between the points designated on Form H, Form A would be used, designating the point at which they would meet.

Form E is used to assist all irregular trains that may be on the road at the time "No. 25" has been delayed 20 minutes for some reason known only to the dispatcher, which enables all trains receiving this order to use the delayed time, thereby keeping all trains moving.

While the explanation of train orders is an interesting subject, it would require too much space to explain all of the different forms and their uses in emergencies, and it might be of interest to some to know that in an examination of the trainmen on the standard rules, there are 250 questions. These examples illustrate how all trains are kept constantly moving.

The system of handling trains is by telegraph. The telephone is used as an auxiliary, and only called into requisition for train orders in cases of emergency, its principal convenience lying in the transaction of business between agents and officers of the company, and between the superintendent of power and his assistants. The dispatching of trains by telephone was discarded for the telegraph in the early operation of the road, on account of the great danger found in combinations of words and figures on the telephone that would cause collisions of trains. The heavy induction on the telephone lines from the high-tension wires on the same poles caused a roar that would transform figures and names of stations into those that were not meant. There were many other dangers incident to the moving of rapid trains in the use of this system which the telegraph has shown itself able to overcome.

In the 44 miles of road are 28 stations, at which trains can meet or pass. Eight of these are each manned by an agent who is a telegraph operator and who, in addition to his duties connected with the commercial business of the company, handles orders for trains. Twenty stations are fitted with telephone booths at which conductors can get instant communication with the train dispatcher. Should a train become five minutes behind its scheduled running time, the rules require that the conductor report at the first telephone booth for a change of meeting points with opposing trains, unless it should be a telegraph station, at which place the orders are always ready, changing the scheduled meet to another point and thus keeping all trains moving, overcoming the delays, and enabling the trains delayed to go to their destinations on time.

A VIEW OF GRADE SHOWING HEAVY SIDE-HILL WORK.

Accounting.

The general system of accounting conforms as nearly as possible to that outlined by the American Street & Interurban Railway Accountants' Association, with sufficient changes and additions to admit of a thorough accounting of the different fares collected and mer-

chandise handled. Agents are maintained at all principal stations, where both single and round trip tickets are on sale. Conductors are provided with round trip tickets for the convenience of patrons who do not have time to buy their tickets at the stations and for patrons boarding the trains where agents are not employed. This form of ticket is illustrated.

TRAIN OF 12, 30-TON HOPPER CARS EN ROUTE FROM RENTON MINES TO SEATTLE.

Ohmer registers of the 12-fare type are used, and it is the policy to have the conductor register each passenger carried. To this end employes are given either a trip or quarterly pass. When a quarterly pass is used the holder thereof is required to sign a receipt, which is taken up and registered as a ticket. This receipt is illustrated.

The company has adopted forms for use in connection with its freight business similar to those in use by steam roads. At stations where the company has agents the shipper gets a receipt for merchandise delivered for shipment. A way-bill is then made out in triplicate by the agent, the original given to the conductor, one copy sent to the receiving agent and the third filed in the office of the forwarding agent. The receiving agent expenses all shipments on a duplicate form. This agent makes all collections, taking a receipt from the consignee and remits to the assistant treasurer daily. Each agent and each conductor is required to make a daily abstract of all freight received and forwarded and send it to the auditor's office, where one is checked against the other and the agent notified of any inaccuracy or failure to report a shipment.

All shipments consigned to points where the company has no agent must be prepaid. Shipments from such stations going "collect" are way-billed by the conductors, who, at the end of their run, send all way-bills, whether received from an agent or made out by themselves, to the auditor, who in turn checks them against the received and forwarded abstracts.

All agents make a daily balance sheet and a daily ticket report. On the last day of the month these forms are sent to the auditor accompanied by a monthly summary, together with a list of the uncollected accounts. As a matter of convenience to a responsible regular shipper, his account is settled weekly, which makes it necessary for the general office to keep well informed and allow none to run over the date on which settlement should be made.

PASSENGER TRAIN MADE UP OF STANDARD ROLLING STOCK.

The revenue, as well as the expenses, are separated on the general books so that it is possible at any time to obtain a statement of either the passenger or freight business, all passenger expense accounts taking the standard schedule and the freight expense accounts being designated by the letter "F" after the name of the account. Charges such as wages of trainmen and repairs to cars are easily distributed

between the passenger and freight accounts, but such items as repairs to track, power, etc., have to be divided according to the mileage, which is considered equitable.

Stone & Webster Form A 640. 50M-8-05.

EXPENSE BILL .... **PRO. NO.** ....

Car Initials.................. *Car No.* .... *W. B.*.................. *Date* ....

Station ....

To PUGET SOUND ELECTRIC RY.

For Charges and Freight from ....

DESCRIPTION OF ARTICLES	WEIGHT	RATE	AMOUNT	

Consignor ....

Freight		
Advances		
Total		

The Expense Bill will be detached, and, on payment of charges, delivered to Consignee. The receipt for delivery of the goods will be signed by Consignee.

Received Payment for the Company,

Agent.

EXPENSE BILL GIVEN SHIPPER. (ORIGINAL $8\frac{1}{4}$x$9\frac{1}{4}$ IN.)

The repair shops are located in Tacoma and occupy an entire block on A St. between 13th and 14th Sts. This location is one block from Pacific Ave., the principal business street of the city. These shops take care of the equipment of the Puget Sound Electric Ry. and the Tacoma Railway & Power Co. The latter company operates the city and suburban lines of Tacoma which have 86 miles of track, 75 passenger, 54 flat and 4 box cars. The machine shop has the latest types of tools including a lathe with a 36-in. swing suitable for boring wheels and a 200-ton hydraulic wheel press. This latter serves for pressing on and off the small wheels used in the city equipments and the 33-in., 700-lb. steel wheels used with the interurban equipments. All the armature winding and electrical repairs for the city and interurban equipments are made in this shop.

Puget Sound Electric Ry. HALF FARE ★

Stub TO BE RETAINED BY CONDUCTOR HH 1

NOTE.

This Stub not good for transportation. Must be detached and forwarded to Auditor by Conductor.

Exact amount paid by passenger to be indicated by punch of Conductor.

W. F. Dimmock, Manager.

TRAIN TICKET

	TO	FROM
SEATTLE	O	O
ARGO	O	O
GEORGETOWN	O	O
MEADOWS	O	O
RIVERSIDE	O	O
FOSTER	O	O
GARDEN	O	O
BLACK RIVER	O	O
RENTON JUNC.	O	O
RENTON	O	O
ORILLA	O	O
O'BRIEN	O	O
KENT	O	O
THOMAS	O	O
CHRISTOPHER	O	O
AUBURN	O	O
STUCK	O	O
BLUFFS	O	O
EDGEWOOD	O	O
MILTON	O	O
FIFE	O	O
WAPATO	O	O
TACOMA	O	O

CASH PAID	15	20	25	30	35	40	45	50	55	60	65				
	70	75	80	85	90	95	100	110	Cts	☆	★				
MONTH	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec			
DAY OF MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

★ HALF FARE Puget Sound Electric Ry.

Return TO BE HANDED PASSENGER HH 1

TO	FROM	
O	O	SEATTLE
O	O	ARGO
O	O	GEORGETOWN
O	O	MEADOWS
O	O	RIVERSIDE
O	O	FOSTER
O	O	GARDEN
O	O	BLACK RIVER
O	O	RENTON JUNC.
O	O	RENTON
O	O	ORILLA
O	O	O'BRIEN
O	O	KENT
O	O	THOMAS
O	O	CHRISTOPHER
O	O	AUBURN
O	O	STUCK
O	O	BLUFFS
O	O	EDGEWOOD
O	O	MILTON
O	O	FIFE
O	O	WAPATO
O	O	TACOMA

NOTE.

This Ticket when properly punched by Conductor will be honored for return passage between stations punched.

Exact amount paid by passenger to be indicated by punch of Conductor.

W. F. Dimmock, Manager.

TRAIN TICKET

65	60	55	50	45	40	35	30	25	20	15					CASH PAID
★	☆	Cts	110	100	95	90	85	80	75	70					
Dec	Nov	Oct	Sept	Aug	July	June	May	Apr	Mar	Feb	Jan				MONTH
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	DAY OF MONTH
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

ROUND TRIP TICKET SOLD ON TRAINS. (ORIGINAL, CARD, $4\frac{1}{2}$x$4\frac{1}{2}$ IN.)

The blacksmith shop is well-equipped for repairing the rolling stock and building special track work. The company maintains a sufficient force to build all its own special track work such as frogs, switches, crossovers, etc. In the blacksmith shop is an 800-lb. steam hammer which has been found very useful. An interesting portion of the blacksmith shop equipment is an improved double furnace 10x12 ft. in size. This furnace is especially useful in building trucks, tempering springs and doing similar steel work. It is of sufficient size to heat at one time the entire side of a truck frame. All the brass castings, journal bearings, trolley wheels, overhead switches,

Stone & Webster Form A-[illegible]

Puget Sound Electric Railway.

CLEARANCE CARD.

.... 190___

Conductor and Motorman No. ___

ORDERS FOR YOUR TRAIN ARE { Form "19" / Form "31" ____

(If any order form "31" all order Numbers will be checked by Dispatcher and)

MADE BY

(If no order form "19" or "31" endorse "NONE" in space provided for order numbers and if none of either form state.)

SIGNAL IS OUT FOR ____

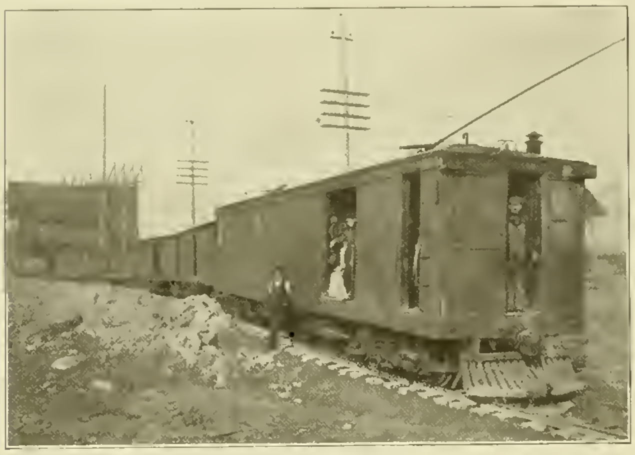
____ M ____ OPR.

This does not interfere with or countermand any orders you may have received.
Conductors must sign orders form "31" before accepting from Operator.
Conductors and Motormen must each have a copy and see that their train is correctly designated in the above form.

CLEARANCE CARD. (ORIGINAL 5x$4\frac{1}{4}$ IN.)

crossovers, car trimmings, etc., are cast in the brass foundry from a portion of the scrap copper which accumulates in the different departments.

On account of the high freight rates to the principal car-building establishments which are 3,000 miles distant, a carpenter shop has been well equipped for doing nearly all of the woodwork necessary. Washington fir and oak are used and have been found to be especially well adapted to this class of work. In the carpenter shop, passenger cars are repaired, overhauled and entirely rebuilt. Street cars for city use are built new at this plant, as are also all the flat and box cars, gondolas and hopper-bottom coal cars. It has been found



MOTOR CAR AND LOCAL FREIGHT TRAIN.

that satisfactory equipment can be built at a much lower cost at the company's shops than can be furnished in the East and the freight rate paid to the Pacific coast. The trucks for the freight equipment are also built in the machine shops. The group of shop buildings includes a paint shop 175 ft. long and 40 ft. wide. This shop will accommodate 10 cars.

The Stone & Webster properties on Puget Sound include 140 miles of track in the cities of Tacoma and Seattle united by the interurban road which has just been described. This extensive property is under the direct management of W. S. Dimmock who has made an especially enviable record in maintaining the high

Puget Sound Electric Railway

Train No.__________ Date__________

Record of__________ Pass No.__________

Used

From__________ To__________

Signature of Holder__________

NOTE:—The signature of the holder of any pass presented and not taken up must be placed hereon; when the conductor will take up this blank and ring for it upon the register.

RECEIPT GIVEN BY PASS-HOLDER TO CONDUCTOR. (ORIGINAL 4x2½ IN.)

standard of the property and perfecting its operating features. During the past four years, Mr. Dimmock has built up a thorough organization, in which work, his earlier steam railroad experience has been of much assistance. Previous to his connection with Messrs. Stone & Webster, Mr. Dimmock was manager of the Richmond (Va.) Passenger & Power Co. to which position he succeeded from the management of the Omaha & Council Bluffs Railway & Bridge Co.

Personnel.

The officers of the Puget Sound Electric Ry. are: J. Furth, president, Seattle, Wash.; C. D. Wyman, Jr., vice-president; Henry Reed Hayes, secretary; G. E. Tripp, treasurer; Stone & Webster, general managers, Boston, Mass.; W. S. Dimmock, manager; J. S. Simpson, auditor and assistant treasurer; C. J. Franklin, superintendent; A. H. Mackay, commercial agent; Geo. O. Snider, purchasing agent; K. Schluss, superintendent of power; W. M. Bosworth, civil engineer, and Wm. Glenn, master mechanic, Tacoma, Wash.

The Bunos Aires Grand National Tramways Co.

It is reported that there are many reasons for believing that the future of the Buenos Aires Grand National Tramways Co. will be a prosperous one. In the first place horse traction is expensive to work and every tramway which has made a change to electrical equipment has been able to show a considerable increase in business and a decrease in working expenses. It may be of interest to review briefly the history of this company. It was formed in 1889 and took over a concession, granted by the municipality of Buenos Aires for about 26 miles of line. The concession is for 60 years, at the end of which period the property, with the exception of the land and buildings, will come under municipal ownership. In 1893 the company entered into an agreement to acquire a concession from a native company for a further 26 miles of line. The capital stock of the company is about $1,250,000. In 1903 resolutions were passed increasing the company's borrowing power by about $3,500,000, of which $3,000,000 was intended for the electrical equipment of the line. So far, only $1,500,000 has been issued.

In 1900, the Grand National company entered into an agreement with Buenos Aires New Tramways Co., usually called the Nueva Co., whereby the former operates the horse section and pools its net receipts with those of the Nueva, the proportions being one-fourth to the latter company and three-fourths to the Grand National. As regards the earnings there has been for some years a steady and substantial improvement. In the past nine years the gross and net earnings have each been quadrupled, the working expenses also declining.

As regards the future, much is hoped from the proposed electrical equipment of the line. Satisfactory progress has recently been made with the work of converting the joint system for electrical operation, consisting of the lines of this company and those of the Buenos Aires New Tramways Co., Ltd. Certain sections electrically equipped were opened to the public on July 1st last, making the whole length of the electrically equipped line at that date, 15 miles. Since then a further extent of line has been equipped, bringing the total up to 24 miles. It will also be remembered that the complete amalgamation with the Buenos Aires New Tramways Co., at present worked by the Grand National, has been proposed, and as this will no doubt become in time an accomplished fact, the outlook for the line is bright.

The New Power House for Washington, D. C.

The power and lighting facilities in the Capital City will be further increased in the near future by the construction of a 19,000-kw. capacity power house for the Potomac Electric Power Co., for which a contract has been let to the J. G. White Co. The Potomac Electric Power Co. is a subsidiary of the Washington Railway & Electric Co. operating 650 cars over about 150 miles of the 200 miles of total trackage in Washington. The remaining 50 miles is operated by the Capital Traction Co.

The new building is to be approximately 166 x 183 x 67 ft. in size and will cost about $1,500,000. It will be of concrete-steel construction. The boiler room will contain four batteries of boilers with three chimneys located between the second and third batteries. The turbine room will be at right angles to the boiler room and will have no basement, its floor lying on about the same level as the boiler room basement.

The first installation will consist of two 2,000-kw. and one 5,000-kw. Curtis turbines and there is provision for a future installation of two additional 5,000-kw. capacity of turbines with their steam generators, which will ultimately provide for a capacity of 19,000 kw. There will be galleries connected by short bridges placed around all the units to permit of easy connection between them and making in effect a secondary operating floor in the turbine room. The turbines will all generate 25-cycle, three-phase current at a

pressure of 6,600 volts, at which pressure the current will be delivered directly to the sub-stations. Of the 2,000-kw. units two are already installed, one of them being equipped with the ordinary type of surface condenser. The remaining units will be equipped with the latest type of condenser placed in the base of the turbines.

The intake and overflow conduits for the condensing water, will run underneath the turbine room, approximately at the center line. There will be a small coal bunker placed over the firing floor of each boiler. The main storage room for coal will be outside the power house and back of the boiler room. The coal will be delivered from the cars to the storage room and then distributed among the bunkers.

The boilers will carry 175-lb. steam pressure at a superheat of 150°. They will be fed by mechanical stokers supplied from the overhead bunkers. All of the auxiliary machinery will be steam-driven and all the prime movers will exhaust into feed water heaters.

The controlling apparatus will be entirely contained in the switch house adjoining the main generating room and will be distributed among three galleries. The ground floor will contain only the outgoing feeders and main generator leads. The second gallery will contain all the bus-bar compartments, disconnecting switches and static apparatus, together with instrument transformers. The third floor will contain both alternating and direct current switch boards.

The number of existing units has not yet been determined, but there will probably be two or three in the first installation. In any case, a booster battery will be installed with the plant which will be capable of furnishing excitation for the entire generator equipment for the period of one hour. This is a good insurance against the possibility of interruption of service by a breakdown.

J. H. Merrill, the Secretary of the Central Electric Railway Association.

Mr. J. H. Merrill, the recently elected secretary of the Central Electric Railway Association, has entered upon the performance of the duties of his new position. His offices are located in the Traction Terminal Building, Indianapolis, Ind., and it is expected that the work of the association will be greatly furthered by this energetic and capable officer.

Mr. Merrill began his railroad experience with the Lake Shore & Michigan Southern Railroad in March, 1889. He was with the mechanical department for three years and occupied a position in the superintendent's office for two years, was with the passenger department for 18 months, the auditing department for six months and then returned to the locomotive and car departments where he remained until March, 1900.

J. H. MERRILL.

His technical education included a mechanical and electrical engineering course in the International Correspondence School of Scranton, Pa. After completing this course and having served in all of the several departments of the steam road, Mr. Merrill took up the work of electric railway construction. He first acted in the capacity of superintendent of construction on the building of a line between Mansfield and Galion, O. Upon the completion of this line, it was consolidated with the 12-mile line previously in operation between Galion and Bucyrus. Mr. Merrill held the position of manager of the consolidated properties until October, 1903, when he resigned to accept the position of purchasing agent of the Western Ohio Railway Co. He retained this position until he was appointed to the present one with the Central Electric Railway Association.

Mr. Merrill's duties will consist of the compilation and publication of time cards and folders of all the roads of the association, the collection and distribution of all valuable operating data, the handling of interchangeable transportation matters, the working out of through passenger and freight arrangements and work of a general nature in the interests of the traction lines.

Plans of the American Street & Interurban Railway Association and Recent Meetings of Allied Associations.

It is announced that the selection of the time and place of meeting of the annual convention of the American Street & Interurban Railway Association for 1906, will be made by the committee in charge at the next meeting of the executive committee of the association which will be held at the New York office of the association the latter part of the present month. In selecting a suitable city for the convention, it is necessary to consider a number of points of vital importance to the success of the convention, including suitable hotel accommodations, commodious exhibition halls, convenience of location to hotels and railways and a suitable hall adjacent to the exhibition building in which the convention exercises may be held

On account of the rapidly growing prominence of the interurban railways in connection with the association work, it is desirable to hold the convention in an interurban district. For this reason an effort is being made to find a suitable convention city in the central states or at some point north of the Ohio and east of the Mississippi rivers. The cities now under consideration by the committee are Cleveland, Columbus, and Dayton, O., Indianapolis, Ind., Louisville, Ky., and Boston, Mass. The members of the committee have visited these cities recently and have taken careful notes of the advantages which each offers for the accommodation of the 2,500 or more men interested in electric railways who will attend this year's meeting.

The affiliated associations of the American Street & Interurban Railway Association are all working in unison to make the 1906 convention more successful than any ever held. At the executive meetings of the engineers' association, the claim agents and the accountants' associations, all of which were held in New York City on February 19th, definite action was taken in arranging the program for the convention. Vacancies in the various committees were filled, subjects to be discussed were named and the work of preparing papers was assigned to various members.

At these meetings the constitution and by-laws of these subsidiary associations were drafted in accordance with the reorganization of the parent association and in co-operation with the allied minor associations. The by-laws and constitution are now in the hands of the special committee consisting of W. B. Brockway, H. H. Adams, and B. V. Swenson, which was appointed by the American Street & Interurban Railway Association to sanction them.

President W. Caryl Ely has appionted committees to investigate and prepare reports on a number of interesting topics among which are the following: "Promotion of Traffic"; "Standards"; "Public Relations"; "Municipal Ownership"; "Welfare Work"; "Papers and Topics"; and "Heavy Electric Railways." These subjects will be investigated in their specific fields and in relation to the association's work, by the respective committees.

Accountants' Association.

The meeting of the executive committee of the American Street & Interurban Railway Accountants' Association was held in New York City on Monday, February 19th. There were present, President W. B. Brockway, first vice-president, P. S. Young, second vice-president, Robert N. Wallis, Mr. C. L. S. Tingley of the executive committee and Elmer M. White, secretary.

The resignation of Mr. J. H. Pardee, general manager, Rochester & Eastern Rapid Ry., as a member of the executive committee, was accepted and Mr. E. F. J. Gaynor, auditor of the Interborough Rapid Transit Co. of New York City, was elected to fill the vacancy. The resignation of Mr. H. C. Mackay, comptroller of the Milwaukee Electric Railway & Light Co., from the committee on standard classification of accounts was accepted and Mr. Frank R. Henry, auditor of the United Railways Co. of St. Louis, was appointed in his place.

Progress was made on the program for the next convention. The Question Box, which has been growing in interest, will be continued and blanks will be sent out in a few days on which the members may indicate the questions which they wish to have answered at the convention. A paper on "Construction Accounts" was assigned to Mr. P. S. Young. In the constitution and by-laws as adopted, no provision is made for associate members and only

the active members of the American Street & Interurban Railway Association are members of this association.

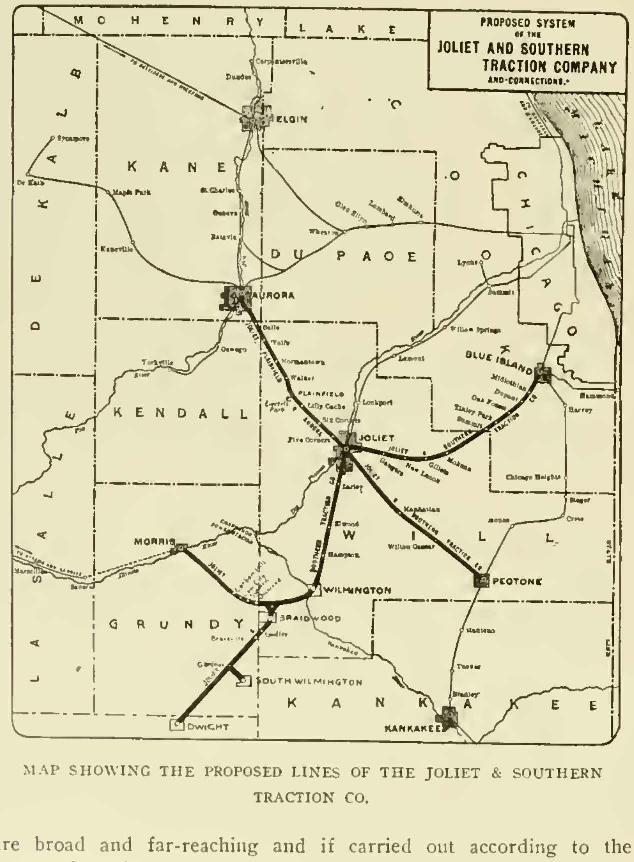
Manufacturers' Association.

The American Street Railway Manufacturers' Association held a meeting in New York City on Friday, February 9th. Mr. Baker presided as temporary chairman. There were present at the meeting Messrs. Baker, Ellicott, Garland, (representing Mr. King), Huelings, (representing Mr. Brill,) Knickerbocker, Martin, McGraw, Nute, Peirce, Randall, Wharton and Williams. There was also present by invitation, Mr. B. V. Swenson, secretary of the American Street & Interurban Railway Association.

Upon motion, the chairman of the finance committee was instructed to have the annual report printed and a copy sent to each member of the association. Messrs. Knickerbocker, McGraw and Peirce were appointed a committee with power to act in unison with the committee of the parent association in deciding upon a meeting place for the 1906 convention. It was moved that a committee of five (with three constituting a quorum) be appointed to draft a new constitution and by-laws and lay them before the executive committee for approval. This motion was carried and Messrs. Baker, Ellicott, Martin, McGraw and Peirce were appointed. An executive committee meeting is to be called for April 26th to consider the proposed reorganization, and a members' meeting is to be called for April 27th.

The Joliet & Southern Traction Co.

The recent presentation to the city council of Joliet, Ill., by the Fisher Syndicate of an ordinance providing for street car rights over certain streets in Joliet, is the first step in the development of a plan that will mean much for the city. The plans of the syndicate



MAP SHOWING THE PROPOSED LINES OF THE JOLIET & SOUTHERN TRACTION CO.

are broad and far-reaching and if carried out according to the present intention will go far toward making Joliet an important traction center. The map shown herewith includes the proposed lines of the Joliet & Southern Traction Co. which is the name of the corporation under which franchise rights are being asked for.

The interurban lines that are projected and on which the syndicate is taking up the necessary right of way and franchises, cover a route south through the towns and cities of Elwood, Wilmington, Braidwood, Braceville, Godley and Gardener to Dwight, in Livingston County, with a branch from Gardener to South Wilmington, and a branch extending from Wilmington west through Diamond, Coal City and Carbon Hill to Morris. At this point connection will be made with the Illinois Traction System for the purpose of bringing the traffic from that line into Joliet. This branch will also furnish transportation facilities from the southwestern part of Grundy County to Morris, the county seat.

Another line is proposed from Joliet southeast through Manhattan, Wilton Center and Peotone, where connection will be made with the Chicago & Southern Traction Co. to Manteno, Tucker, Bradley and Kankakee.

Probably the most important of the proposed lines is the one to Blue Island which practicaly parallels the Rock Island R. R. At Blue Island connection is to be made with the new terminal tracks of the Chicago & Southern Traction Co., which will connect with the South Side Elevated R. R. at about 74th St., assuring rapid transit between Joliet and Chicago.

The franchise now before the city council of Joliet is intended to provide terminal facilities for all of these interurban lines which will make Joliet the center of the system with lines radiating as shown. It is said that options have been secured on two pieces of property in the heart of the city, one to be used for a large terminal station and office building, where all of the interurban cars of the system will deliver and receive passengers in a manner similar to the plan in operation at the terminal station of Indianapolis. It is proposed to erect on the other property several large car barns and shops. In the future it is intended to build all additional equipment required for this system in the company's own shops. Negotiations have been opened with a water power development company south of Joliet for using a large portion of the electrical energy to be required by the traction system.

The officers of the Fisher Syndicate are: H. A. Fisher, president; F. E. Fisher, general manager, and L. D. Fisher, chief engineer. These men have demonstrated, through the building of the Joliet, Plainfield & Aurora R. R., their ability to successfully construct and operate a system of this nature.

The Report of the Ninth Annual Convention of the Street Railway Accountants' Association.

The Street Railway Accountants' Association of America has issued its report of the ninth annual convention which was held in Philadelphia on September 28th and 29th. The report contains the annual address of President W. G. Ross, managing director of the Montreal Street Railway Co., Montreal, Canada, the report of the executive committee, the report of the secretary-treasurer, the Question Box and remarks by Hon. W. Caryl Ely, president of the American Street & Interurban Railway Association. Reports of the various committees are contained and include the one on the international form of report, the one of the committee which attended the convention of the National Association of Railway Commissioners, the report of the committee on standard classification of accounts and the discussion on these various reports.

The following papers are also included: "The Cost of Carrying a Passenger," by C. L. S Tingley, second vice-president of the American Railways Co., Philadelphia, Pa.; "Interurban Fare Collections," by Irwin Fullerton, auditor of the Detroit United Ry.; "Interurban Ticket Accounting," by J. H. Pardee, general manager of the Rochester & Eastern Rapid Railway Co., Canandaigua, N. Y.; "Accounting With Four Departments," H. M. Beardsley, secretary-treasurer, Elmira Water, Light & Railway Co., Elmira, N. Y.

The report contains about 300 pages and reflects much credit upon Mr. Elmer H. White, the secretary-treasurer of the association. It is a complete verbatim record of the transactions of the convention and includes a number of illustrations in connection with the various papers presented.

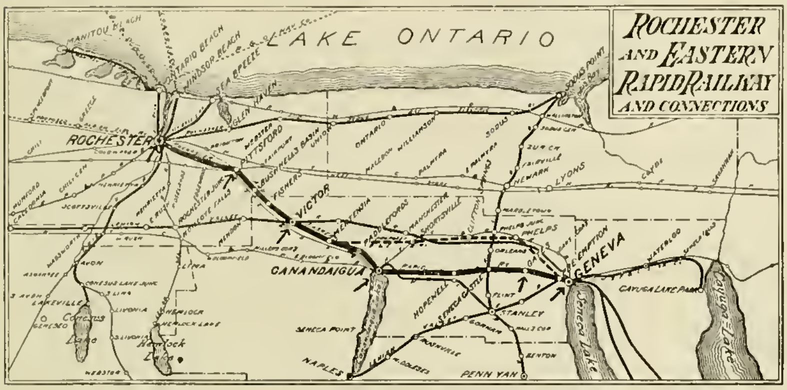
It is announced that the lines of the Columbus, Delaware & Marion Railway Co. will be extended from Marion to Bucyrus, Ohio, a distance of 21 miles. A spur six miles in length is to be built to Richwood, while in Marion, extensions covering three miles are to be put in. A power house is located at Stratford in which is being installed three large turbine engines, having a combined capacity of 18,000 h. p.

Train Dispatching on the Rochester & Eastern Rapid Ry.

BY W. R. W. GRIFFIN, SUPERINTENDENT.

In presenting this discussion of the method of train dispatching on the Rochester & Eastern Rapid Ry., I do not propose to offer any freak or startling system, but to describe an old system applied to a new situation with a few distinct and possibly unique additions. Before entering directly upon the subject of dispatching, I wish to review briefly the evolution of electric railroading, and also the causes that led up to the ultimate decision of the Rochester & Eastern to adopt its present method of dispatching.

The first steps taken in electric railroading were upon our city streets, where in the early days, the electric propulsion was applied to the then existing horse cars, and as time went on the size of the cars was increased until we reached our present city standards. On the single track, turn-outs were placed in the streets a suitable distance apart to maintain the traffic. These turn-outs were almost always in sight of the man handling the cars from turn-out to turn-out. Consequently, it required but very little direction upon the part of the railway officers to keep the cars moving and avoid collisions. In some locations double tracks were built. This allowed the movement of cars in one direction on one track and in an opposite direction on the other track. Thus the problem of keeping the traffic moving was still more simplified.



MAP OF THE ROCHESTER & EASTERN RAPID RY.

The dispatching of this class of train work is ordinarily carried on by inspectors or starters who are more or less immediately upon the ground. As our city systems enlarged, it became necessary to extend the tracks along the country roads into the suburbs. The same methods of operation, in the majority of cases, were still applied. These same systems were still further extended along the country highways until they connected town and city. The tracks still being upon the highways where they had to mingle with other traffic, the methods practically remained the same. This method of extension gradually led up to a new system of electric railroading in which the towns were connected by lines built upon private right of way where they did not mingle with other traffic, consequently allowing higher speeds. As the speeds increased, larger and heavier cars were used.

When this progress had been made, it was impossible to have the operation under the direction of men immediately upon the ground, consequently the electric railway people in casting about for means of handling their cars, naturally came to use the telephone.

Unfortunately, when this time came, the majority of the trains were being operated by the same class of men that had been trained in city work. They were used to personal direction and when they came to handle trains by telephone they fell into the same plan, directing their train movements by word of mouth, with little or no records of such movements.

A few years ago, I was acquainted with a large interurban railroad that operated under a system of dispatching which was the outgrowth of what has just been outlined, although it did attempt to keep a record or train sheet. This road had no written book of rules. All rules governing operation were posted in bulletin form as necessity demanded. Trains were operated under numbers, odd numbers in one direction, and even numbers in the opposite direction, with a printed time table giving the meeting time at stated passing points.

The odd-numbered trains were given right of track by direction, with a three-minute leeway. In other words, if an odd-numbered train reached a regular scheduled meeting point three minutes late and the even-numbered train that it should have met there was not in sight, the odd-numbered train would continue regardless of the other. Should the odd-numbered train be more than three minutes late and the opposing train not in sight or on the siding, the motorman was supposed to stop and call up the dispatcher at a telephone booth placed at the siding. Then if there were any directions as to change of meet necessary, the dispatcher gave his verbal orders. The even-numbered train always had to take care of itself and was supposed to be at the regular schedule meeting point strictly upon the time given on the time table. Unfortunately this system often led the motorman of the even-numbered train to take advantage of the time allowance and this oftentimes led him into trouble.

Form 317. 100M. 8-05.

Indiana Union Traction Company.

TRAIN ORDER BLANK, FORM A.

Order No............. *Date*.................. ......*190*....

To Conductor and Motorman,

Train No............ *Motor No*............ *at Siding No*............

Meet Train No...................... *Motor No*............ *at Siding No*............

Meet Train No...................... *Motor No*............ *at Siding No*............

....

....

....

....

....

Complete.................. .... *M*.............................. ... .

Dispatcher.

FIG. I. EARLY FORM OF TRAIN ORDER BLANK, INDIANA UNION TRACTION CO.

FT. WAYNE & WABASH VALLEY TRACTION CO.

TRAIN ORDER BLANK

Order No...................... Date .... 190.... Time............

Train No................ *Motor No*...............

Meet Train No .... *Motor No*................ *At Siding No*..................

Meet Train No................ *Motor No*................ *At Siding No*..................

and report at Siding No. ....

....

....

CONDUCTOR	MOTORMAN	TRAIN	AT	O. K.'D BY DISP.	TIME
....	....	....	....	....	....
....	....	....	....	....	....

HANG ON HOOK

FIG. 2. EARLY FORM OF TRAIN ORDER BLANK, FT. WAYNE & WABASH VALLEY TRACTION CO.

In the checking of these trains by the dispatcher there was no time placed upon the train sheet except at the beginning and ending of the run. If the dispatcher should not hear from a train at the starting point, he would naturally enter the regular scheduled time of that train as its leaving time. If he did not hear

Blank and Blank Railway Company.

Order No.________ Date________190____

At________to C. & M. Train________Car________

At________to C. & M. Train________Car________

At________to C. & M. Train________Car________

Train No.________Car No.________will meet train No________

Car No.________At Siding No.________

Received by	O. K.ed by	
Conductor	Dispatcher	Time

FIG. 3. FORM OF ORDER, BLANK & BLANK RAILWAY CO.

from certain trains, the dispatcher would simply place an "x" at the siding where these trains were scheduled to meet an opposing train, doing this under the supposition that they had made their meets correctly and upon time.

As this was the only kind of train record kept there was no way of checking up the dispatcher or the train crews. Whenever trouble happened, which was frequently under this system, there was always a chance that one man would claim one thing and another the opposite. I venture to state that this entire class of men knew nothing, or practically nothing, of the dispatching methods used by the steam railroads. They were either ashamed or afraid to try to learn the same methods, consequently they endeavored to handle trains under the name of dispatching, without knowing the first principles of such methods. I believe that the majority of interurban roads failed in the beginning in a way similar to this.

This led up to getting out a form of written order, of which the train order blank of the Indiana Union Traction Co. is a sample. These orders were telephoned to the trainmen and written out by them. After being repeated to the dispatcher, the order was complete and the train was allowed to proceed. On this earlier class of order there is no record showing that the train crews really received it.

The next later orders had the form of those illustrated of the Ft. Wayne & Wabash Valley Traction Co. and the Blank & Blank Railroad Co. These orders had spaces ruled at the bottom for the signature of one or both of the trainmen. These orders were received, written and completed by one member of the train crew, generally the conductor, on one single sheet and delivered to the other member. All orders received by the crews during the day were supposed to be turned into the office and checked. The records in a great many cases of this kind were simply duplicate

Blank and Blank Railway Company.

Order No.________ Date________190____

At________to C. & M. Train________Car________

At________to C. & M. Train________Car________

At________to C. & M. Train________Car________

Car No.________will run extra from________

to________

Received by	O. K.ed by	
Conductor	Dispatcher	Time

FIG. 4. EXTRA ORDER, BLANK & BLANK RAILWAY CO.

orders as made out by the dispatcher and placed upon a pin file. All these orders were given for meets.

The time came when the different companies began to see the necessity for dispatching extras and work trains, which were not represented upon the time tables and also to see that there should be some kind of order for protecting such irregular trains. Some of the companies got out additional blank orders similar to the sample extra order of the Blank & Blank Railroad Co. By adding these different movements the train crews had to carry several different forms of blanks and this often led to confusion.

Another step in advance was represented by the blank consolidating orders such as is reproduced herewith and used by the Rochester & Eastern Rapid Ry. when it first began operating. This order was intended to handle all the different movements of the regular as well as the extra and work extra trains. I wish to call special attention to the one very bad defect in the latter order, and in fact this same defect appears in all orders that are made out in stereotype, the major portion of which are so printed that the train crews are required to simply enter in figures the car numbers, train numbers and siding numbers. It will be noted by reference to this order No. 100, that "train 10" "car 8" was ordered to meet "train 7" "car 4" at "siding 3." The figures "8" and "3" almost invariably fall one above the other and the tendency of men in reading the stereotyped forms is to simply glance at the place where the number of the siding is supposed to be. Thus there was considerable chance of error by mistaking the upper figure for the lower one. This would naturally lead to disastrous results.

The Rochester & Eastern made an improvement by adopting the form of which No. 162 is a sample. On this blank the position of the meeting point space is shifted and each meeting point given a name as well as a number. This order produced very good results with the exception that it gave no permanent record since the dispatcher made his copy on a duplicate order blank and placed the second sheet on a pin file. In case of trouble or when there was

ROCHESTER AND EASTERN RAPID RAILWAY COMPANY.
TELEPHONE TRAIN ORDER.

Order No. 100 Date Jan 1st 1902

At Windsor to Conductor and Motorman of Train 10, Car 8

At .... to Conductor and Motorman of Train ....., Car

At .... to Conductor and Motorman of Train ....., Car

Train No. 10, Car No. 8 will meet Train No. 7, Car No. 4

at Siding No. 3.

Car No.

Train No.

Order No

Received by

Operator.	Time.	Conductor.	Train.	Time.	O.-K'd by.
Jones	9¹⁵ a.m.	Brown	10	9¹⁷ a.m.	M H B.

Brownson, Despatcher.

This Order Transferred to and Received by Relieving Conductor________

at________ Time________

FIG. 5. BLANK CONSOLIDATING ORDER, ROCHESTER & EASTERN RAPID RAILWAY CO.

any chance of dispute over such orders, it was a very easy matter to destroy either of the original orders and write a new one, thus making it impossible to determine who was to blame.

Another defect in the whole system of dispatching that has just been outlined is that scarcely any of the roads using these forms have rules governing what should constitute an order, consequently the chances are great for a receiving man to think that the dispatcher means one thing, while in fact he intends another.

This condition led to the adoption by the Rochester & Eastern of an entire change of method of electric train handling. Whenever an electric road is so built and equipped as to be able to operate electric cars capable of distancing parallel steam trains, then I maintain that the electric railroad has entered fair and square into the realm of steam railroading.

These conditions do exist and as the steam railroads have spent the past 40 years or more in providing a safe method for handling their trains on both single and double tracks the electric railroads can better themselves by adopting these same methods. To this end about a year ago the management of the Rochester & Eastern Rapid Railway Co. adopted the American Railway Standard Code of train operating. This code not only gives definitions for all terms used in railroad train operating but prescribes set rules governing the use of the time table and the classification and movement of trains, the rules governing all movements by train orders. It gives proper set forms for wording all orders covering particular movements and furnishes each member of all trains affected with such order. It also exhibits a copy of the same

worded order and a complete set of train signals to be displayed, in order that all trains may know each other by such markings.

The American Railway Standard Code prescribes certain dispatching orders to be given for any movement of trains other than those governed by the regular scheduled time table, and also

ROCHESTER AND EASTERN RAPID RAILWAY CO.

TELEPHONE TRAIN ORDER.

Order No. 162 Date 11/11 1904

At ______ to Conductor and Motorman of Train ______ , Car ______

At Pittsford to Conductor and Motorman of Train 113 , Car 100

At ______ to Conductor and Motorman of Train ______ , Car ______

Train No. 34 , Car No. 8 will meet Train No. 113 , Car No. 100

AT Brick Yard Y !

Car No. ______
Train No. ______
Order No. ______

RECEIVED BY			
Operator.	Time O. K.	Conductor.	Train.
Turner	5 32 A.M.	Case	113

COMPLETED BY	
Despatcher.	Time.
M. N. B.	5 35 A.M.

This Order Transferred to and Received by Relieving Conductor ______

at ______ Time ______

FIG. 6. LATER TYPE OF TELEPHONE TRAIN ORDER.

prescribes the definite wording of each order. It also prescribes that these orders shall not be stereotyped, but written in pencil and copied in manifold, the same arrangement and wording being given all trains concerned.

One change in the American Standard Railway Code was necessary to meet the conditions obtaining on the Rochester & Eastern Rapid Ry. The steam railroads transmit their orders by telegraph. After receiving the order, the operator repeats to the dispatcher the words he has written, and if they are found correct the dispatcher gives the operator an O. K. and the time when given.

This order is not considered complete and cannot be acted upon by the train crew until signed by one or both members of the crew. Their signatures and train number must then be telegraphed to the dispatcher when he will answer "complete," giving time and initials, all of which must be entered on the order by the operator before the train can proceed. In the stations of the Rochester & Eastern where operators are maintained, the method of transmitting orders is the same as that in use on steam roads, except that on the Rochester & Eastern after the order is received and the O. K. obtained by the operator, the telephone is used instead of the telegraph. The order is made complete by being repeated by the conductor to the dispatcher over the telephone, the conductor giving his name and train number to the dispatcher. If the order as read by the conductor checks with the dispatcher's copy it is then completed by the dispatcher giving the word "complete" and the time when the conductor enters his name on the order.

Since each train carries a telephone instrument and direct communication with the dispatcher can thus be effected, the standard rules had to be changed to allow the transmission of an order direct to the crew. Whenever it becomes necessary to give an order direct to the train crew, the motorman acts as operator, receiving, writing, and getting the O. K. after which the order is completed by the conductor in the same way as at the stations.

It will be noted on steam roads that only two men actually handle the wording and making of an order, whereas under the methods employed by the Rochester & Eastern, there are always three men concerned in this transaction. This adds a greater degree of safety as men have been known to have listened to and repeated back words other than those they have written. Where the third man reads back the order for completion he will naturally read the actual words written and thus avoid mistakes. This is one feature of the Rochester & Eastern system of train dispatching that is distinctly different from the American Railway Standard Code, because there is always one member of the train crew who communicates directly with the train dispatcher regarding any order. Thus we are always sure that one member of the train crew understands what he is ordered to do.

Another distinct feature is the dividing of the line into five sections each having six stations, and placing these sections in positive blocks. On the map the block stations are indicated by arrow points. At three of these block stations, Rochester, Canandaigua and Geneva, a train register is maintained in which the train crews must record the arrival and departure of their trains, stating the class of the train and whether it is represented on the regular time table or is running as a section or an extra. Thus any trainman can ascertain positively if any due or overdue train has arrived. In the other stations, Pittsford, Victor and Gates, the operators maintain a register which shows the position of all trains.

No train is allowed to leave any one of these stations without an order. This order must always be obtained for the train by the station operator. If there is any movement to be made by the train other than that scheduled upon the standard time table, the train is given what is termed a clearance order. This clearance order simply allows the train to fulfill whatever movement is scheduled or ordered beyond the point from which it is given and up to the next blocking point.

The time table gives each train a definite number, odd numbers east-bound, even numbers west-bound, and the meeting points are indicated on the time table in half full-faced type, small type being used for the number of the train to be met.

At the bottom of the time table is printed the rule stating that trains of the same class have no rights over each other. In

Dispatcher's Train Order Book. 79

ORDER NO.	TO WHOM AND WHERE ADDRESSED	OPERATOR AND TIME O. K.	JAN 29 1906 ORDERS	CONDUCTOR AND TIME COMPLETE
122	Ex. "O" C & M Sid. 8. No. 201 C & M Cdga.	4.26 Paul 4.32 Carter	Car "O" will run Extra Sid. 8 to Canandaigua with right over No. 201. W.R.H.G.	Cole X"O" 4.27 Timm #201 4.37
123	No. 201 C & M Cdga. Ex. "O" C & M Victor	4.41 Carter 4.43 Wade	Extra "O" East will meet No. 201 Car 101 at Hathaways' Sid. 18 W.R.H.G.	Timm #201 4.4[illegible] Cole X"O" 4.50
124	24/5 Cdga.	4.5[illegible] Carter	No Orders.	
125	C & M Car 30 Pitts	No. 93 4.53 Williams	Cars 30 and 1 will run as 1st and 2d No. 93 Pittsford to Rochester and No. 98 will display Signals Rochester to Pittsford for Car 30. W.R.H.G.	Simmons 1-93 4.56 Martin 2-93 4.58
126	96/7 Pitts	4.55 Williams	No Orders.	
127	95/6 Cdga.	5.08 Carter	No Orders.	
128	97/4 Geneva	5.10 Kelly	No Orders.	
129	96/7 Victor	5.20 Wade	No Orders.	
130	24/6 Gates	5.25 Armstrong	No Orders.	
131	27/14 Gates	5.2[illegible] Armstrong	No Orders	
132	1-28/1 Rochester	5.26 Case	No Orders.	
133	2-28/30 Rochester	5.2[illegible] Case	No Orders,	

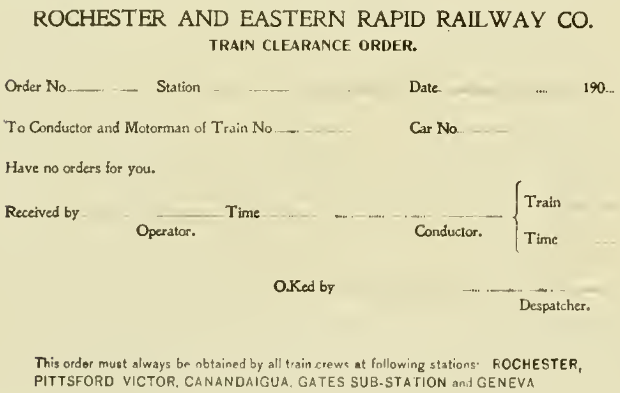
FIG. 8. SAMPLE PAGE FROM DISPATCHER'S TRAIN ORDER BOOK.

other words, the trains must positively meet as scheduled upon the printed time table unless otherwise ordered by the dispatcher. This may look like a backward move in railroading, but it must be remembered that with trains running under 60-minute headway, time allowances must be shorter than on steam roads which have greater intervals between trains. The Rochester & Eastern gets better results from its telephone system than could be obtained by the use of the telegraph and does not need specially trained

operators. The train crews can obtain orders directly and thus avoid any tie-up. An instrument is mounted in each car and temporary connection can be made with the lines by means of a pole and contact hooks.

The records in the dispatcher's office are kept on a train sheet. A record of the orders is kept in a book of which the accompanying illustration is a sample page. Each order as given must be written in the same identical words which were received by the train crew. The book is ruled and there are spaces for the order number, the station name, the operators' names, the time at which the O. K. is received, the name of the conductor, the number of his train and the time of completion of the order. This order No. 122 was received by the motorman of car No. "o" at siding No. "8," through a car telephone and completed by Conductor Cole. Now since that order carried with it rights against a scheduled train, the same order was placed in Canandaigua with the operator and was there completed by the conductor of that train and so on with all the other orders.

In connection with the system of operating an electric railroad under the American Railway Standard Code, the question natur-


ROCHESTER AND EASTERN RAPID RAILWAY CO.
TRAIN CLEARANCE ORDER.

Order No.______ Station ______ Date ______ 190__

To Conductor and Motorman of Train No.______ Car No.______

Have no orders for you.

Received by ______ Time ______ Operator. ______ Conductor. Train ______ Time ______

O.K.ed by ______ Despatcher.

This order must always be obtained by all train crews at following stations: ROCHESTER, PITTSFORD VICTOR, CANANDAIGUA, GATES SUB-STATION and GENEVA

FIG. 7. STANDARD FORM OF TRAIN CLEARANCE.

ally arises as to how it is possible to properly educate the trainmen, since electric trains invariably require but two men, while steam roads usually have five men, and thus have always ample opportunity to gradually educate a portion of this crew. It is very true that in order to properly operate a road under the American Railway Standard Code, a trainman and especially the motorman must be thoroughly familiar with these rules. The safety of any train, operated by either electricity or steam, depends almost entirely upon the engineer or driver since he is the man who must see and interpret all signals and virtually execute the orders. Consequently greater care must be used in selecting this man than is required for the rest of the train crew.

The American Standard Code comprises about 254 rules governing the movement of trains. The Rochester & Eastern Rapid Ry. requires all of its motormen and conductors to pass a written examination upon these rules in which they have to answer 276 questions. These questions are so worded, that even though a man should memorize the book of rules, he would still be unable to answer them if he had no practical knowledge of their fulfillment.

Another thing that the Rochester & Eastern has discovered, since adopting the American Railway Standard Code, is that it is able to pick up at any time steam railroad trainmen of all classes who are thoroughly familiar with the train operations under the standard code. We have men now in service who have come from the Buffalo, Rochester & Pittsburg, the Lehigh Valley, the New York Central, the Erie, Wheeling & Lake Erie, and several other roads that are operating under the standard code. We also have applications from conductors, locomotive engineers, firemen and trainmen, who are now working on these roads, so the question of being able to get proficient trainmen simplifies itself.

One of the rules of the Rochester & Eastern is that no man can become a motorman unless he has had at least two years' train service on some steam road, is perfectly familiar with the standard code service and can pass the examination on it. He must also have a good letter from the superintendent under whom he last worked, or must spend at least a year in the service of the Rochester & Eastern as a conductor. Thus it will be seen that we are reasonably sure of having good railroad men on the front platform of all electric trains.

A Recent Merger of Traction Properties in ths State of Washington.

The recently announced incorporation by J. P. Graves and associates of Spokane, Wash., of the Inland Empire Railway Co., with a capitalization of $20,000,000, would seem to indicate that this new organization means the building of considerable additional mileage in connection with the roads which the company already has leading out from Spokane. The new incorporation is a merger of four companies, the Coeur d' Alene & Spokane Railway Co., which has a line 34 miles long in operation between Spokane and Coeur d' Alene; the Spokane Traction Ry., which has an extensive street railway system in Spokane; the Spokane & Inland Railway Co., which has a line partially built into the Palouse country from Spokane, and the Spokane Terminal Co., which is building a terminal station in Spokane for the other three companies. When the extensions and improvements of the merger companies have been completed, the new Inland Empire Railway Co. will include about 200 miles of track.

Mr. Graves states that the new company proposes to develop its own water power by building a dam across the Spokane River near the mouth of Deep Creek, about nine miles below Spokane. By building this dam the power for a large electrical plant could be furnished. To this end, the Spokane & Inland Co. has recently secured additional riparian rights to those which it already holds along the river. The officers of the new Inland Empire Railway Co. are J. P. Graves, president, F. Lewis Clark, vice-president and F. A. Blackwell, chairman of the board of directors.

A Satisfactory Method of Insulating Field Coils as Practiced in Syracuse.

Some time ago Fred DuBois, master mechanic of the Syracuse Rapid Transit Railway Co., devised a scheme for insulating field coils that has proven efficient and has since been adopted by some of the electrical supply houses. The plan is simple and so inexpensive because of its durability, that the company is now using it almost entirely in constructing its field coils.

The general method of winding the coils is the same as heretofore, but instead of placing the layers close together and depending on the immersion of the coil in asphaltum paint to fill up the spaces between the wires, a thin layer of paste, composed of powdered whiting and Sterling varnish, is applied to each layer of wire as it is wound. The paste is applied as thickly as it can be worked with a brush, and hardens without being subjected to a great heat. When allowed to dry it becomes as solid as cement and unites the coils into one mass. After the coil is allowed to air dry for a short time the outside tape is wound about it as in the other methods. It is then dipped in asphalt paint or varnish and placed in an oven for four hours, after which the coil is ready for use.

The company has been experimenting with this method of insulating field coils for nearly three years and during that time has never had a short circuit in any coil treated by this method. The paste when properly applied forms a cushion for the wires and, being hard, prevents them from vibrating. It is found that after the coils have been in use for a short time the wires become so securely imbedded in the paste that it is necessary to tear them from the insulation with great force in order to remove them. These coils weigh about five pounds more than the ordinary coils and cost about 50 cents more per coil.

A practice on the Aurora, Elgin & Chicago Ry. that is of considerable interest is a stop report made by the conductor to the motorman. For this purpose a blank 2½ x 8 in. is provided on which are printed the names of the stations. When collecting his fares, the conductor marks the stations at which it will be necessary to stop to discharge passengers. This he delivers to the motorman, who hangs it on a hook provided in the motorman's cab. He is with this record enabled to more intelligently regulate the speed of his train.

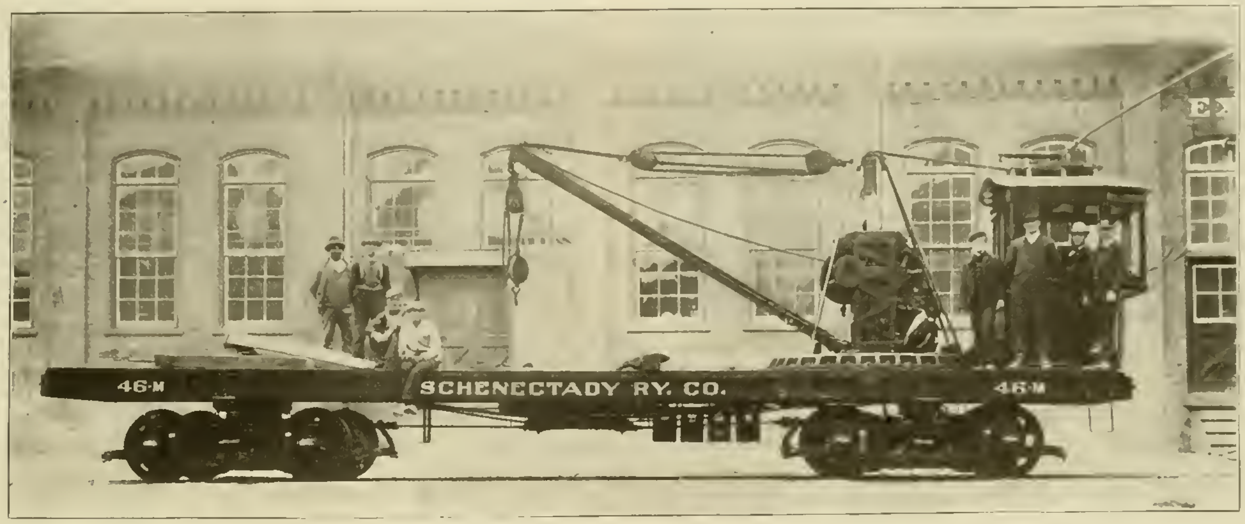
Crane Car, Sweeper and Benefit Association of the Schenectady Railway Co.

In addition to its regular equipment of cars, the Schenectady Railway Co. has a useful crane car, which was designed and built at its own shops. This car is used for lifting and transferring machinery and conveying material to all points on the lines. The car is known as type 46-M. It has a length of 45 ft. 7 in., a width of 8 ft. 5 in. and a height of 11 ft. 9 in. It is mounted on Brill type 27E-1 trucks, has 33-in. wheels and the usual series-parallel K control system.

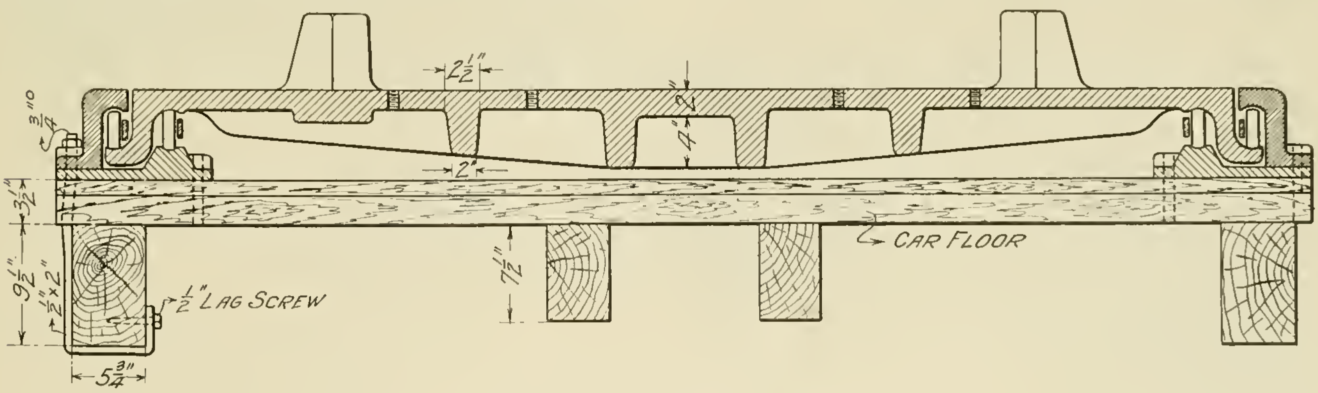
The crane has a lifting capacity of five tons. The framework is made of cast iron with its center placed seven feet from one end of the car. The boom has a swing of 10 ft. on either side of the car. The bulkhead to which the lifting ropes of the boom are attached is nine feet high, and 1¼-in. manila ropes are used. The ropes work through wrought iron guard blocks and over a 10-in. drum with a 14-in. face. The ropes for the hoist are operated directly by a separate drum. An accompanying illustration shows the detail design of the crane table and bed with their roller bearings.

There has been installed on this car a 3-h. p. GE, type-CE slow speed motor, operating on 500 volts pressure and geared to the hoisting drum. The motor is series-wound with a speed reduction of six to one and is equipped with a GE type-R28, 500-volt controller. The brakes on the drums are so arranged that they become automatically released when a load is being lifted. The drums revolve with the gear only when it is hoisting. The load is raised by the motor and is lowered steadily by friction. The accompanying illustrations show the car and the details of the floor.

A very efficient snow sweeper which was built at the company's shops is shown in the accompanying line drawing. The sweeper has an over all length of 28 ft. 5 in. and an inside length of 24 ft 5 in. The width is 9 ft. 2 in. and the height from the rail to the top of the trolley board is 8 ft. 5 in. It is mounted on McGuire trucks having a wheel base of 6 ft. 6 in. and the diameter of the wheels is 33 in.



CRANE CAR OF THE SCHENECTADY RAILWAY CO.



DETAILS OF THE CRANE TABLE AND BED.

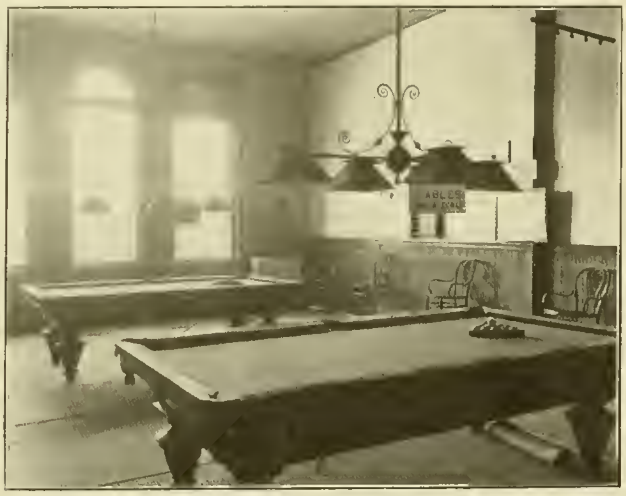
Schenectady Railway Benefit Association.

Through the agencies of benefit associations, street railway companies and their employes are brought into closer relations, resulting in a better mutual understanding. The Schenectady Railway Co., Schenectady, N. Y., has such a benefit association, and as its workings have been generally successful, a presentation of its plans and methods of operation may be of interest to other electric railways contemplating the organization of similar associations.

The objects of the association include the collection and dissemination of interesting matter pertaining to the construction and maintenance of street railways and their equipment, as well as matter in connection with the manufacture and distribution of electric current for lighting and power purposes; the promotion of good fellowship among the employes of the company, and lastly the care of its members in times of sickness or disability and, in the event of death, the aiding of the beneficiaries of its members, providing such sickness, disability or death is not due to intemperance.

The Schenectady association has a membership of 325. Each of its members, according to the constitution of the society, is an employe of the Schenectady Railway Co. and contributes 50 cents per month to the association. This amount is deducted from the wages for each month preceding the date on which the payment falls due. If, at any time, the funds of the association are not

sufficient to meet all obligations, the board of trustees has the right to levy an assessment equally upon all members, but such special assessment cannot exceed 50 cents in any one month or three dollars in any one year. Should a member of the association leave the employ of the company, his name is at once removed from the rolls of the association. Should he leave before the end of the month, for which he has paid his dues, a proportional amount of the money for the unexpired period is refunded to him.



POOL AND BILLIARD ROOM, SCHENECTADY RAILWAY BENEFIT ASSOCIATION.

READING ROOM, SCHENECTADY RAILWAY BENEFIT ASSOCIATION.

Under the benefit clause of this association, members are entitled to payments while totally disabled or unable to labor by reason of accident or sickness, receiving one dollar for each day after the first seven days for a period not exceeding 90 days in all. In case the employe is disabled a second time, within less than two weeks after the first recovery, the disability claim is added to the prior one in computing the 90 days. In no case is more than $90 paid to any member during any one year.

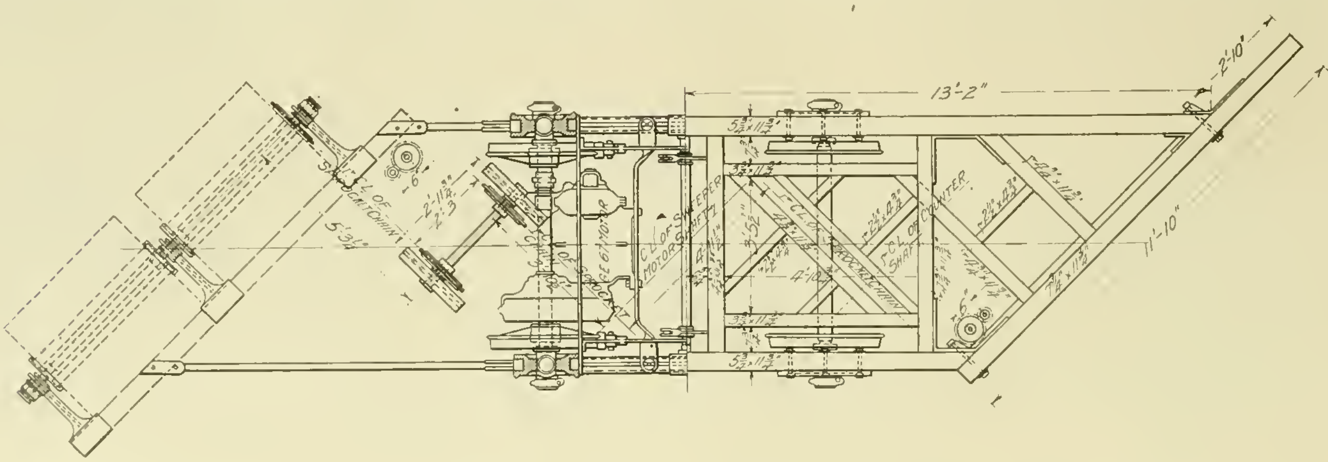
In the event of the death of a member, providing such death is not caused by intemperance or immoral conduct, his beneficiaries receive the sum of $150. Application for all disability claims is made to the division superintendent or to the head of the department of the division on which the applicant is employed. The superintendent or head of the department endorses such application and in the event of his questioning the payment, states his reason therefor and forwards them to the secretary of the association. The medical examiner then makes a physical examination of the applicant and submits a report. The secretary again considers the application and if allowed directs the payment of the benefit. In case any application for sick benefit is disallowed or payments stopped the member affected can appeal to the board of trustees, whose decision in the matter is final.

The officers of the association consist of a president, vice-president, secretary, and treasurer. The president or general manager of the Schenectady Railway Co. is, according to the constitution of the association, always president of the association. The vice-president is elected at the annual meeting by a majority vote of the members present; the treasurer of the railway company is always treasurer of the association; the secretary is appointed by the board of trustees. The management of the association affairs is vested in a board of trustees consisting of seven members, of which the president of the association is chairman. Three members of the board of trustees are appointed by the president of the railway company and three are elected by a majority vote of the members present at the annual meeting. In case of a vacancy on the board a temporary appointment is made by the president. The decision of the board of trustees is final on all questions relating to the management of the association.

One business meeting of the association is held each year. Other meetings can be called at the request of the board of trustees or of 35 members of the association. At these meetings 35 members constitute a quorum. Each member of the association is entitled to one vote.

During the year many social functions are held in the association rooms. Some of these are "smokers," while others are devoted to musical and literary entertainment for the benefit of the members' families and friends. At these meetings the uses of electricity are discussed and lectures are given on electrical equipment. In the reading rooms of the association all the leading technical periodicals are kept on file for the benefit of the members. To aid in supplying the reading matter for the association rooms the company gives $100 annually.

Any member of the Schenectady Railway Co. over 21 and under 45 years of age is eligible to membership upon payment of one dollar as an initiation fee and the 50 cents dues for the first month. It is not compulsory that an employe of the company join the



PLAN VIEW, SHOWING GENERAL ARRANGEMENT OF SNOW SWEEPER.

association. All dues paid to the treasurer are placed to the credit of the association and used for no other purpose than sick and death benefits. All money not needed for benefits is invested under the direction of the board of trustees in suitable securities.

BOWLING ALLEYS, SCHENECTADY RAILWAY BENEFIT ASSOCIATION.

The quarters occupied by the association are located on the second floor of the railway company's shops, on Fuller St., where the members are allowed to spend their leisure hours at all times of the day or night. As is shown in the accompanying illustrations, the main club rooms consist of an assembly room, a reading room, a billiard and pool room and a bowling alley. Locker,

ASSEMBLY ROOM, SCHENECTADY RAILWAY BENEFIT ASSOCIATION.

cloak and wash rooms and baths are provided. Each one of these rooms is well furnished and arranged for the comfort of the members.

The present officers of the association are: President, E. F. Peck; vice-president, Geo. Stevenson; treasurer, J. H. Aitkin; secretary, W. F. Stanton.

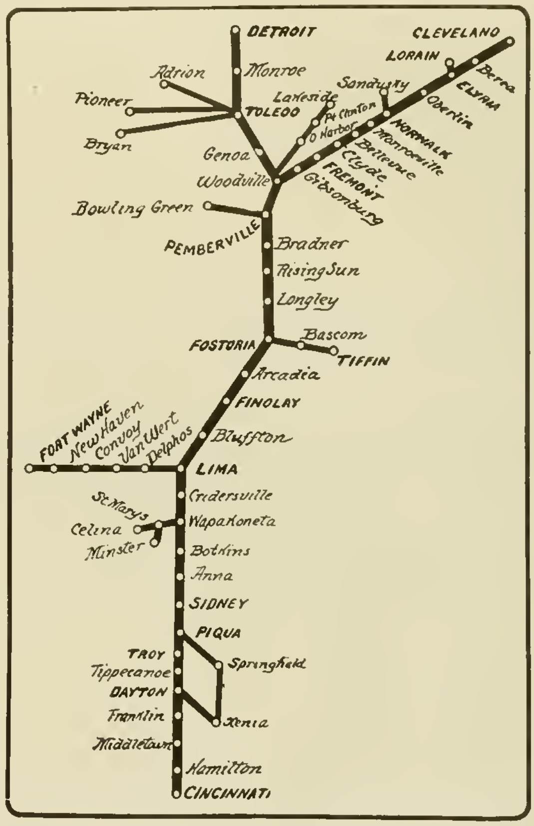
The International Railway Co. at Niagara Falls, N. Y., is testing the new Maxim Surface Contact System, in which electrical connections placed between the rails transmit current to the car through a shoe carried by the car.

The Worcester Polytechnic Institute will erect a large building for the exclusive use of an engineering laboratory. The design of the building, it is expected, will be suitable for accommodating the Electrical Railway Engineering Department, which was established at the institution a few months ago. Mr. Albert S. Richey, who is well-known in the interurban railway field, has charge of the department of the institute.

The New Rate Sheet of the Toledo, Fostoria & Findlay Railway Co.

In the "Street Railway Review" for January, 1906, there appeared an account of the opening of the Lima-Findlay division of the Western Ohio Railway Co. This was an event of considerable importance since the opening of this line makes possible uninterrupted interurban communication between the cities of Cleveland, Detroit and Cincinnati. The line of the Toledo, Findlay & Fostoria Ry. forms another link in this chain, connecting the limited service of the Lake Shore Electric Ry. at Woodville, O., with that of the Western Ohio Ry. at Findlay, O.

By reason of this through connection a traffic agreement has been entered into by the various lines forming the chain. General Manager F. W. Adams, of the Toledo, Fostoria & Findlay



MAP OF THE TOLEDO, FOSTORIA & FINDLAY RY. AND ITS NORTHERN AND SOUTHERN CONNECTIONS.

Railway Co., has recently issued a new rate sheet, containing the straight and return rates and routing instructions from Findlay to all points on lines to the north. The lines included are the following: The Toledo, Fostoria & Findlay Ry., the Lake Erie, Bowling Green & Napoleon Ry., the Lake Shore Electric Ry., the Toledo, Port Clinton & Lakeside Ry., the Tiffin, Fostoria & Eastern Electric Ry., the Detroit, Monroe & Toledo Short Line Ry., the Toledo & Indiana Ry., and the Toledo & Western Ry.

This sheet is arranged on the same plan as those issued by steam roads. It is furnished to the agents of all the company's connections south of Findlay in order that they may construct through rates by adding their rate up to Findlay. The back of the sheet bears a map of the Toledo, Fostoria & Findlay Ry. and its northern and southern connections, which is illustrated herewith. This map shows the lines previously mentioned through which this through traffic arrangement has been made possible.

This is probably the first basing sheet ever issued by an electric line. It foretells much for the future and the arrangement will no doubt bring about a considerable increase in the freight and passenger traffic on this and all connecting lines.

At a meeting of the stockholders of the proposed Indianapolis & Chicago Air Line Traction Co., the name of the road was changed to Ohio & Indiana Ry.

THE
STREET RAILWAY
REVIEW
AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE
KENFIELD PUBLISHING CO.,
45-47 PLYMOUTH COURT, CHICAGO, ILL.
Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:
New York—39 Cortlandt St. London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:
Austria, Vienna—Lehman & Wentzel, Karntnerstrasse.
France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
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Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

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Entered at the Post Office at Chicago as Second Class Matter.

Vol. XVI MARCH 15, 1906 No. 3

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REMOTE CONTROL FOR LINE CIRCUIT BREAKERS.

The great majority of street railway feeder systems in large towns or cities are divided into a number of separate trolley sections and each is supplied with power by an independent cable, the several or more cables being connected in multiple at the power station bus-bars. In order that faults in trolley wires or cables may be localized in their effect upon the power station, circuit breakers are, in standard practice, installed between the bus-bars and each feeder. The line breakers in the trolley wires prevent the effect of a short circuit or other serious disturbance in any given section from becoming general throughout the overhead system.

Unfortunately the use of section insulators in this way often prevents the most efficient use of the copper installed between the power houses and the cars, and the provision of emergency switches in street boxes only slightly mitigates the trouble. With the recent improvements in relay switches for multiple-unit control it ought to be a simple matter to install a few such switches in place of the knife switches at locations where the use of feeder sections in parallel would greatly improve the regulation and insure a much lower copper loss per division. Then by the use of a single small wire connecting with the power house the switch could be reset in case of an opening, without the loss of time which would be occasioned if an ordinary circuit breaker or knife switch were installed at the insulated joint. The extension of any local trouble through adjacent sections would be merely temporary with such an arrangement, which ought to result in a considerable annual reduction in overhead losses at a very moderate first cost.

DUPLICATION IN POWER PLANT DESIGN.

The amount of duplicate apparatus which it is desirable to install in a modern power plant depends, to a large extent, upon the conditions prevailing in the territory served, but in general there may be observed in the more modern designs a marked tendency to get away from the large reserve capacity which characterized many of the earlier installations. This means, of course, that present day equipment is, on the whole, better able to operate continuously than the apparatus which was developed in the younger period of the electric railway industry. Any one who has followed the development of power station machinery from the early nineties to the present day cannot help realizing that designers are constantly trying to impart a more rugged simplicity to their productions. Prof. Elihu Thomson well said in an address before the Worcester Board of Trade that the development of electricity direct from coal would be a great commercial triumph only in case the apparatus employed is simple, durable and of low maintenance cost per annum.

Duplication of apparatus is of much more importance in a power plant made up of a considerable number of small units than in a case where three or four machines supply all the power generated. The keynote of the problem is the importance of providing for continuous service, which simply means the anticipation of all except the most extraordinary emergencies. With the larger power units of the present day, many of which are from two to four times the capacity of whole stations built on the plans considered standard ten years ago, the available overload capacity is so great that in case a generating unit breaks down it is often possible to tide over the emergency without much difficulty and also at high operating efficiency.

To get a better idea of the diminished necessity for duplication, let us begin at the coal pile and follow the energy transformation through a typical alternating current generating plant equipped with four 5000-kw. steam units and 3000 kw. capacity in rotary converters for the direct-current bus bar supply at the station. There is certainly little need of two coal pockets in a plant of this kind, provided that a single structure can be built on the available land capable of holding, say, a month's supply of fuel, in round num-
with four 5000-kw. steam units and 3000 kw. capacity in rotary con-
but the principle of duplication in the hoisting and conveying apparatus does not enter.

In any plant of this size, mechanical stokers are likely to be considered as essential. Here it would seem the part of wisdom to install the engines or small motors which operate the moving grates, in duplicate, so that the failure of an engine or motor would not tie up any section of boilers. The cost of duplicating very small apparatus of this kind is, in almost every plant, such a low

percentage of the value of the equipment to which it is an auxiliary that the investment and operating expenses are not to be considered prohibitive if the apparatus really insures the more economical or reliable operation of the station as a whole.

In a modern power plant, the question of duplication applies perhaps with more force to the high-pressure steam piping than to any other part of the equipment. A few years ago, the idea was widely held that a large part of the high-pressure piping should be installed in duplicate, so that in the event of a rupture in any important line, another would be at hand to take its place. The designing of such systems proved so cumbersome, however, that it was not carried out in many of the more important installations. The modern practice of installing plants in sections, and tying those sections together by one or two headers at one end and by the busbars at the other, gives better results, with the advantage of reduced investment, fixed charges and maintenance expenses. The increasing use of superheated steam makes it necessary to reduce as much as possible the number of valves and joints which must be kept tight and there is no doubt that the maintenance of tight joints in a large system of high pressure piping is one of the most troublesome matters encountered in the operation of a large power plant.

In the illustrative case under consideration, therefore, we shall adopt the sectional principle in the station layout, connecting each boiler to a single steam header, and supplying each turbine from that header by a single line of piping. The runs will be as short as possible, and in normal operation each battery of boilers will supply only the corresponding turbine. The header may be used as an equalizing primary receiver if desired, or it may be valved and shut down except in case of trouble at any boiler or its steam line, in which case any turbine can be fed from any battery.

Between the turbo-alternators and the switchboard no one would think of running duplicate cables, for temporary repairs can be made with great rapidity in case of a burnout, and certainly sooner than any armature coil can be replaced in the generator. At the switchboard the bus-bar problem is a question of flexibility of operation rather than of reliability, but a jumper bus is often a great convenience in direct current feeder panel supply. In a sense, it is doubtless true that the installation of four 5000-kw. units is a duplication in design, but in a case of this character it is more probable that the designer could in reality confine his duplication to the provision of an ample margin in overload capacity, falling back upon this reserve power or in some cases upon a storage battery in preference to installing an additional unit of equal or smaller size. In case one of the 5000-kw. units breaks down when the four are operating at full load, it is only necessary to operate the remaining units at 33½ per cent overload to carry the station load through the time of the peak. The installation of forced or induced draft in a plant of this size would be a help in addition to the stack, in the boiler room, if any boiler or battery should have to be shut down.

As for auxiliaries, the provision of extra sources of feed water supply, pipe lines, pumps and even heaters, is a small part of the total plant cost. The practice is very common, even in the largest plants, of installing a single primary feed water heater for the whole installation, but it is open to considerable doubt if this is not less economical and certainly less flexible than the installation of two heaters, and sometimes three, of smaller individual rating.

Turning to the rotaries, the provision of ample overload capacity is probably the simplest method of securing reliability in case of trouble. A large number of small rotaries is seldom desirable in a plant of this magnitude. The transformers need not be duplicated, but a spare unit is exceedingly important. If single-phase sets are employed with very large three-phase transformers it would probably be better practice to keep on hand spare coils than to invest in a costly unit which would stand idle a large part of the time. Equipment which bears in its cost but a small proportion of the total cost of a plant should be duplicated without hesitation, provided it forms a part of the chain of transformation between the coal bin and the outgoing lines. Very large and extensive apparatus should be provided with liberal overload capacity and maintained at a high point of operating efficiency. Sometimes, as in the case of the New York Central terminal plans at New York, the installation of duplicate power plants is desirable, but the general trend of present practice is in the direction of the utmost possible simplicity and the minimum idle investment consistent with operating safety and reliability.

POWER PLANT REPAIR SHOPS.

Almost every electric railway power plant needs facilities for making light repairs. In a good many cases it happens that the general repair shop of the company is located close by, so that there is no necessity for fitting up an elaborate equipment within the power house walls. When the power house is located out of easy walking range of the general shop, it would certainly seem the part of wisdom to provide some sort of a workshop on the immediate power house premises, so that temporary repairs can be quickly effected in case of trouble.

Power house routine always includes a lot of small jobs in connection with the piping and auxiliaries which can usually be done at odd moments and therefore at slight expense by some one of the operating staff. If a large generating unit breaks down it frequently happens that the necessary repairs cannot be made at the power house without the help of the more extended shop facilities to be found in the department of rolling-stock maintenance, but this is no argument against the provision of a lathe or two, a grinder and a drill press for the general power house use, because in a good many cases temporary repairs can be made so quickly on the spot that the cost of the tools is little or nothing in comparison with the time saved in the end. As a rule, the operating man in the power house takes a live interest and pride in making repairs of this kind, and it is a fact that the presence of the few simple tools needed is a strong incentive toward the production of labor-saving contrivances for use in the plant, if the policy of the management is such as to encourage inventive ability.

In planning a small shop for a power house, there should be a liberal allowance of space, good lighting facilities and the provision of a small motor to drive the entire equipment. There is little object in buying expensive direct-driven machine tools with variable speed motor characteristics unless the plant is a mammoth establishment. Seldom are all the tools used at once in such shops; a good deal of the time the whole equipment may be shut down and the power cost of the work done is insignificant. The interesting point is this: light repairs carried on outside the plant cost more in labor and time than those effected on the spot for when it becomes necessary that spare or extra parts be supplied by the main shops, just so much delay and expense is added to the regular work of rolling stock maintenance, without utilizing the mechanical ability of the power house force itself. It may cost three or four hundred dollars to install a first-class engine lathe, drill press and grinder in the power house, with the motor and shafting necessary to drive this equipment, but once it is in, the presence of the tools constitutes an added insurance against protracted breakdowns and a source of real economy in the minor items of power house maintenance.

INTER-SUBURBAN SERVICE.

It is a difficult problem to know just how to handle the traffic between the various outlying districts of a large city when the public demands a rapid car service on fairly short headway from one suburban community to another. In comparison with the total traffic handled the inter-suburban business is of course only a small percentage of the total business of any system. Where the bulk of the traffic consists of passenger movements inward and outward upon lines radiating from the business section to the outlying districts, the public cannot reasonably expect as frequent or convenient an inter-suburban service as between those suburbs and the city.

At the same time, it is possible to improve the conditions of inter-suburban travel considerably in many instances, and thereby gain both in traffic and public good will. It is a well-known fact that in the stress of handling the ebb and flow of traffic between the congested district of a large city and its outlying suburbs, it is easy to lose sight of the quality of service offered between the residential sections themselves. Now, as a mtater of fact, the travel between many of these communities, especially in the evening hours, is often much larger than the management realizes, for the reason that the registers do not separate the inter-suburban traffic from the passenger movement between the suburbs and the

city proper. It very generally happens that the inter-suburban routes finally terminate in the congested district of the city. The result of this is that passengers are obliged to transfer frequently in passing between two widely separated suburban points, sometimes two or three times in a half hour, and as the schedules cannot be maintained with anything like the short intervals feasible upon the main routes, it is impossible to avoid long waits in making connections. In stormy weather there is no doubt that the automobile and the cab often reap the reward which would otherwise go to the street railway, and there is also no doubt but that waits of 15 or 20 minutes at transfer points tend to discourage inter-suburban travel even on fair nights. It often follows that an hour is required to traverse the devious routes which connect two suburbs only three or four miles apart in air line, and the service offered between small cities of the same population as these suburban districts over a regular interurban line is usually much better.

We are not aiming these remarks at any single system. The argument applies with more or less force to all of the large cities in which the residential quarters are considerably separated. Suburbs are always radial in location from the city to which they are tributary, regardless of the configuration of the congested district. It would seem that a more thorough study of inter-suburban traffic would be well worth while in many cases, particularly in the instances where it is quicker to go into town and then out again than to follow the course of existing routes outside with the transfer point delays before mentioned. Such a study might lead to the establishment of one or more belt lines over which continuous transportation from one suburb to another could be had on a 10 or 15-minute headway. The cars need not enter the city proper at all, nor is it essential to perform a complete circle around the suburban territory of the given municipality.

The establishment of such a service, if properly advertised, might often lead to a very considerable revenue. Of course, the details depend entirely upon local conditions, for some suburbs are as distinctly separated by social and other barriers as though they were a hundred miles apart. There is often a tendency to relegate the oldest cars to these routes, which is in certain cases, worth looking into. In any event, the connections and schedules in force between suburbs should be posted at waiting rooms and in the cars so that the public can at least plan its inter-suburban journeys with reasonable expectation of going through in a prescribed time.

THE 99-YEAR ACT.

In 1865 the Illinois State Legislature passed a law, since known as the "99-year act," which has just been interpreted by the United States Supreme Court. This interpretation has brought about vital changes in the Chicago traction situation. The developments leading up to this decision are not only historical but interesting:

In August, 1858, the Chicago common council passed an ordinance granting to Frank Parmelee and his associates the right to lay tracks and operate a street car system on certain streets in the south and west divisions of the city of Chicago. A year later Parmelee and his associates incorporated the Chicago City Railway Co. Shortly afterwards the council gave to that incorporation the right to extend its lines over a number of other streets. Each of these ordinances provided that "the right to operate such railways shall extend to the full time of 25 years from the passage hereof, and at the expiration of said time the parties operating said railways shall be entitled to enjoy all said privileges until the common council shall elect by an order for that purpose to purchase said tracks of said railways, its cars, carriages, station houses, station grounds, depot grounds, furniture and implements of every kind and description used in the construction or operation of said railways, or any appurtenances in and about the same."

Other ordinances were passed by the council for several years, practically based in regard to the limit of time upon the first one In July, 1863, the Chicago City Railway Co. sold out all its rights in the west division lines and in certain east and west lines on the south side, to the Chicago West Division Railway Co., which, of course, succeeded to the rights and limitations of the Chicago City franchises. Thereafter separate ordinances were passed for the Chicago City company and the West Side company, most of which were mere amendments to the original ordinance.

On Feb. 6, 1865, the legislature passed a law, which has since become quite famous as the "99-year act." The old Chicago City Railway Co. had been incorporated for a term of 25 years. The act of 1865 extended the term of incorporation of the company to 99 years. This the United States Supreme Court now holds to have been done legally, but it merely concerns the corporate life of the companies, and does not affect their rights to the streets. The companies however, maintained that this act not only extended their corporate life, but also extended their franchises to the same degree. Furthermore, they maintained that the effect of the 99-year act was to render null and void all the limitations as to time in any further ordinance, so that the right to use the streets must be terminated by the corporate life of the company, and not by the limitations fixed by the city council. This interpretation of the law, if sustained, would have made practically all ordinances in the city of Chicago, no matter how or when granted, continue in full force until in the neighborhood of 1957.

Since then the company has retained its South Side independent corporate existence; the West Division company has been merged into the North Side company under the name of the Union Traction Co.; and both the South Side and the Union Traction companies which covered the rest of the city held to their original contention that the 99-year act extended all franchises. The city from the outset denied this and persisted in putting limitations of time in all the ordinances. The contentions were fought out in one way or another until finally Judge Grosscup, in the United States Circuit Court, rendered a decision which is now overuled by the Supreme Court.

Judge Grosscup decided in favor of the companies in regard to all ordinances and franchises in existence prior to May 3, 1875. The result of Judge Grosscup's decision would have been that all franchises passed up to 1875, expired on or about 1958, and those after that time at the dates and on the conditions mentioned in the specific ordinances. It was a victory for neither side and was relished neither by the city nor the street car companies, both of which appealed. The Supreme Court now has declared as to all the original lines owned by the Chicago City Railway Co., on the south and west sides and transferred to the west division company and through that dormant organization to the Union Traction Co., that the city now is in a position where it can buy up the property and equipment.

Manager Dalrymple's Suggestions for Municipal Ownership in Chicago.

The report of James Dalrymple, the Glasgow traction manager who investigated street railway conditions in Chicago with an eye to the possibility of municipal ownership, was recently made public in Chicago.

In accordance with Mayor Dunne's request for more detailed information certain additional notes were sent by the Glasgow expert of which the following is the substance:

The administration of the street railway department should be entirely under the control of the city council which should appoint a transportation committee and the general manager. The committee might, with advantage, appoint sub-committees on finance, extension, stores and staff.

The sub-committee on finance would carry through all financial transactions, pass on all accounts for payment, and receive reports from the general manager regarding the revenue and expenditure of the undertaking. All proposals regarding extensions of the system should be remitted to the sub-committee on extension for consideration and report. The sub-committee on stores could take charge of the drawing out of specifications and schedules for the carrying out of any work for the department and also for the purchase of material and supplies. The sub-committee on staff could consider all salaries and wages, hours of labor, and general condition of service.

The general manager should be appointed by and be directly responsible to the city council through the transportation committee. He should have absolutely no connection with any political party and his appointment should be made solely on account of his fitness for the position. The city council should give the general manager complete control of the whole staff

Under the general manager and directly responsible to him,

there should be three heads of departments; chief engineer, traffic superintendent and financial superintendent. The chief engineer will require the assistance of an electrical engineer, a mechanical engineer, a civil engineer, and a draftsman.

The traffic superintendent shall have charge of the car service and all the car service employes.

The financial superintendent shall have under him an accountant, with a bookkeeping staff, cashier, pay clerks, purchasing clerks, corresponding clerks, etc.

In the organization of a municipal railway department, a great deal depends on the arrangements that are made for the selection and training of conductors and motormen, and also on the standard of efficiency that is set up and maintained. We in Glasgow rarely engage a man who has been in street railway work before, and we have made it a rule never to re-engage a man who has been in our service. We engage all our men with the understanding that, after serving for a few months conducting a car, they must, when asked, go through the motor school and learn to drive a car. If a man fails to qualify as motorman he has to leave the service.

The working hours of the traffic staff in Glasgow are, on an average, nine hours a day. The staff works any six days out of the seven. When we started operations we allowed the men to work seven days if they choose, but we have now a strict rule in force that no man is to be allowed to work more than six days a week. We find this is a good rule and it is strictly adhered to. The corporation always pays what is recognized as the trade union rate of wages, and where no union rate exists, we pay whatever is recognized as a fair rate in the district.

Our routes are divided into stages of over half a mile each on the average. For each one of these stages, a passenger pays one cent. If he desires to travel further, he can travel over any four consecutive one-half penny stages for two cents, any six stages for three cents, and eight stages for four cents, etc. Whenever a passenger pays his fare the conductor punches a ticket in the section over which the passenger is entitled to travel. The passenger is bound, so long as he is on the car, to retain this ticket and exhibit it to the conductor and inspector when asked to do so.

In Glasgow and in several of the other large cities the street railway department has its own power station. For our system which is designed for about 250 miles of single track and 900 cars we have a power station with a total capacity 11,000 kw. and a staff of 100 men. We have current at 6,500 volts, converted at five sub-stations to 500 volts direct current.

In order to keep the track in perfect order a large staff is required. We have at present rather over 150 miles of single track and we have altogether in our permanent way department 650 men. These men are divided into squads of various sizes, each squad being responsible for the maintenance of the lines in a certain district. Each squad is under the charge of a separate foreman, the whole being under a civil engineer, who is responsible to the chief engineer.

Another department of the service is the staff charged with the erection and maintenance of the overhead equipment. This staff is divided into three sections: construction, maintenance and emergency.

We find that the most suitable size of a car barn is to have accommodation for from 150 to 200 cars. In designing your car barn you should have, near the entrance gate, a commodious office for the accommodation of the motormen, conductors and the traffic staff generally. In a car barn holding, say, 200 cars, it is necessary to have an office measuring 720 sq. ft. There should also be a store for the material used by the repair staff, a fitters' workshop, and a room for the cleaners, where the men can store their cleaning materials, brushes, etc.

Ample kitchen, lavatory accommodation and baths should also be provided. We have also in our car barns a large recreation room, fitted up with gymnastic appliances, tables, chairs, drafts, chests, bagatelle, etc. At all our car barns there are car pits almost over the whole barn for convenience in inspecting and repairing trucks and motors. Our most recently constructed barn has accommodations for 180 cars, and covers 14,747 sq. yd. The cost of the land was $25,000 and the cost of the building was $127,000.

It is advisable to have one general workshop for the maintenance of the rolling-stock and all equipment connected with the street car service. We in Glasgow have a workshop covering an area of over 25,000 sq. yd. In this workshop we not only do repair work but we have built all the 700 cars belonging to the department. In addition to the general store which is adjacent to the workshop we have a sawmill, car shop, repair shop, paint shop, blacksmith shop and fitters' shop.

Our practice in Glasgow has been to insure against accident claims. The private corporation which has taken this work in hand has a room in the office of the department and all reports and claims are immediately handed over to the insurance officials, who investigate such accidents and settle or contest all claims. Last year we paid a premium amounting to about $75,000. This insured us for claims in connection with any single accident amounting to $12,500 and an annual total of $125,000.

The form of our income and expenditure statement and also of our capital account is almost exactly the same as that which has been adopted by the street railway corporations of America. I think in issuing your annual statement you could not do better than to have it prepared on the American form.

I think you would find it advantageous to inaugurate a society among the men belonging to the street railway department. In Glasgow we have had a flourishing Friendly society for a number of years. Membership is quite optional. Out of a total staff of 4,400 we have 3,370 members. In Glasgow each member pays 12 cents per week to the funds of the society and the department adds 6 cents. When a member is off for sickness on a doctor's certificate he receives 15 shillings, or about $3.60, a week for the first six months; 10 shillings, or about $2.40, for the second six months, and five shillings, or about $1.20, for the second year. He also receives medical attendance and medicines free of charge. Admission lines to infirmaries and convalescent homes are also available for members and their families.

It would be advisable also to institute a superannuation fund, which can be accumulated so that it will be possible to grant a small weekly allowance to members of the staff who after long service, may have become unfit for work. We have instituted such a fund in Glasgow, and we are accumulating it as speedily as possible. To this fund 2 cents per week per member are contributed by the members of the society. These two cents are taken from the 12 cents contributed to the Friendly society and the department adds another 2 cents. This fund does not come into operation until 1911. A municipality cannot throw off its old and infirm servants as a private corporation can do and, therefore, it is well to make provision for them.

Program of the March Meeting of the Central Electric Railway Association.

Secretary J. H. Merrill has recently announced the program of the next regular meeting of the Central Electric Railway Association which will be held at the Claypool Hotel, Indianapolis, Ind., on March 22nd.

The morning session will be called to order at 10:30 and will be given over to a business meeting and to the reading of a paper on "Electric Railway Signals" by E. J. Burke, president of the Blake Signal & Manufacturing Co., Boston, Mass. The reading of this paper will be illustrated by a working model.

The afternoon session, which will be called to order at two o'clock, will be devoted to the reading of the following papers: "Fire Insurance at Cost" by Henry N. Staats, manager of the Associated Railway & Light Cos.; "Railway Y. M. C. A. Work" by E. L. Hamilton, railway secretary, Chicago, Ill.; "Advancements and Improvements in Air Brakes" by W. V. Turner, mechanical engineer for the Westinghouse Traction Brake Co., Pittsburg, Pa., with an introduction by S. D. Hutchins, special representative of the Westinghouse Traction Brake Co. The Westinghouse Traction Brake Co. has shipped from Wilmerding, Pa., its large rack which is composed of five complete brake equipments, including all the necessary piping. This will be on exhibition.

In view of the fact that the meetings of the association are to be held but once in every two months instead of each month as formerly, and also in view of the elaborate program that has been prepared, Secretary Merrill is very desirous that every member of the association be present.

Electric Service Supplies Co.

Among the important consolidations that are from time to time announced in these pages the following account of the merger of several well-established firms will be noted with much interest.

The Mayer & Englund Co. of Philadelphia, Porter & Berg of Chicago, Garton-Daniels Co. and Electrical Devices Co. of Keokuk, Ia., will be consolidated under the name of the Electric Service Supplies Co. This name is distinctive, being new and broadly descriptive. Railway supplies and materials will continue to be the specialties of the new company.

C. J. MAYER.

A. H. ENGLUND.

The name of Mayer & Englund Co. has stood for many years as a synonym for reliability in electric railway supplies. The firm of Porter & Berg has enjoyed the largest electric railway supply business in the western field and has been a great recognized leader. The Garton-Daniels Co. has built up a strong reputation for lightning arresters and has long been recognized as the pioneer in the controller regulator field. These regulators, known to the trade under the name of the "Automotoneer," are manufactured by the Electrical Devices Co., also of Keokuk.

By a consolidation of these interests, the Electric Service Supplies Co., will have eastern and western warehouses and sales departments and a manufacturing department. The business of each of these departments will be continued as at present, and under the same management. All correspondence, orders, etc., should be sent to the same addresses as in the past.

The business of Mayer & Englund Co. was founded in 1895 by C. J. Mayer and A. H. England, who first had offices in the Betz Building, Philadelphia, Pa. In 1897 the business had grown to a volume that demanded a larger home. This was found at No. 10 South 10th St. Here the business prospered rapidly. By 1901 it occupied the entire five stories and basement at No. 10 South 10th St. During this year these quarters were entirely outgrown and the business was moved to 1020-1024 Filbert St., a building of nine stories 60 x 80 ft. in floor area. Here the company is now installed with the commodious offices and warerooms described in the "Street Railway Review" for September, 1905. These warerooms contain the largest stock of electric railway materials and electrical supplies in the East.

J. W. PORTER.

MAX A. BERG.

The business of Porter & Berg was established in 1899, by J. W. Porter and Max A. Berg. It prospered from the start in its quarters on the ground floor of the Manhattan Building, Chicago. In 1902 the business was incorporated under the same firm name. Larger quarters were found in the Plymouth Building at 303 Dearborn St., where the entire second floor is occupied as offices. Across the street, at 45 Plymouth Place, are the warerooms, where a complete line of the materials and supplies handled by the new company is carried. Practically every electric railway in the west has come in contact with Porter & Berg's progressive and dependable methods. It will be welcome news that hereafter they will handle and carry in stock at Chicago the same line that has been standard with the Mayer & Englund Co.

The Garton-Daniels Co. is one of the oldest firms in the electrical field, the business having been founded in 1892 at Keokuk, Ia. This name is almost synonymous with lightning arresters, as hundreds of thousands of this company's arresters are in use by electric railway, light and power plants, in all parts of the world The management of this business has been in the hands of J. V E. Titus since 1895, and under his direct control as president since 1903. The Electrical Devices Co. is an allied company, founded in 1901 to carry on the development and manufacture of the controller regulators sold under the trade name of the "Automotoneer." The sale of both lightning arresters and automotoneers has increased very largely in the last two years. The plant at Keokuk will be available for the manufacture of many of the specialties of the Electric Service Supplies Co.

J. V. E. TITUS.

One of the immediate results of this consolidation will be the carrying, in its Chicago warehouse by the Porter & Berg department, of a large stock of the specialties and standard supplies that have been sold heretofore by the Mayer and Englund Co's. agency and supplied from its Philadelphia warehouse. Now, for the first time the western trade will be served with these desirable lines, without delay, from Chicago. Both the Philadelphia and Chicago stocks will be increased and enlarged to include a full line of all standard electrical and mechanical supplies for railway, light, power and mine trade.

The Garton-Daniels department will be increased to enable it to handle more promptly its largely increased business. The manufacture of other specialties will be turned over to this department in the near future.

Among the leading specialties manufactured or sold by the Electric Service Supplies Co. are the following: Protected rail bonds, Keystone overhead materials, Garton-Daniels lightning resters, the "Automotoneer," trolley vestibule shades, Nuttall gears, pinions, trolleys and trolley repairs, International registers, register fittings, enameled badges, Brady Brass Co's. motor bearings, journal boxes and check plates, Lyon sheet-steel gear cases, Sterling varnishes, Crouse-Hinds headlights, Locke high-tension insulators and pins, Speer carbon brushes, etc. In addition to these there will be sold a complete line of supplies for electric railway, light and power plants, mines, etc.

The personnel of the Electric Service Supplies Co. will consist of C. J. Mayer, president, J. W. Porter, first vice-president, J. V. E. Titus, second vice-president, Max A. Berg, secretary and A. H. Englund, treasurer. Each of these officers will have charge of practically the same departments of the business as heretofore. The result will be that customers will be dealing with the same men as in the past. At the same time the resources of the larger company will be available to improve the facilities of handling the business. When the new organization is completed, it will have sales offices in the following cities: Boston, New York, Philadelphia, Pittsburg, Cleveland, Chicago, Atlanta, Birmingham, New Orleans, St. Louis, Keokuk, Kansas City, San Francisco and Los Angeles.

The gross earnings of the Lake Shore Electric Ry. for the month of January show a gain of $11,000.

Piping and Power Station Systems.—XV.*

BY WILLIAM L. MORRIS, M. E.

Piping from Safety Valves.

In piping safety valves, the most satisfactory method is to run the pipe for each valve through the roof. When there are a large number of boilers each having two valves, this will require considerable cutting of the roof, but as a rule it is cheaper to run each pipe to the atmosphere. The increased expense would in all probability be justified, because with the separate pipes the operator can, by going up on the roof, readily tell which valve blows first, which is leaking, the amount of leak, etc. If, on the other hand, the pipes are tied together in one main, it becomes difficult to determine which valve is blowing or leaking. Many plants use a short stub and allow the steam to escape into the boiler room, whenever the valves blow off. This is wrong, as the firemen have enough hardships without having any more put upon them under the plea that if they look after the pressure it will not blow. There are times when the pressure can be controlled, but more often this is not the case. By allowing the steam to escape into the boiler room, the operator will lose money, for no one will stay in the room full of steam if he can, by any excuse, get out, and if he does stay, he will do nothing until the disturbance ceases.

In most cases, one valve will open before the others and may continue to blow by itself for five minutes. This may be one of two valves on a 250-h. p. boiler, discharging say 10 per cent of the output of the boiler. The boiler might possibly be using 1,000 lb. of coal per hour, hence a 10 per cent blow-off would waste 100 lb. of fuel or a loss of 10 cents per hour for coal. If for any reason three employes leave the room during the blow-off period, the employer will lose at the rate of not less than 60 cents per hour. Thus if he desires that the inside blow-off arrangement be profitable he must reduce the number of blow-offs to less than one sixth of what it would be if piped through the roof. This is impossible.

Fig. 128-(A30-1) shows an independent pipe from the safety valve passing up through the roof. Where there are a number of such pipes the use of cast iron roof collars is justified. These collars should be about 3/8 in. thick, with the exception of the threaded hub of the umbrella which should be about 3/4 in. thick. The upper portion of the collar is used as a coupling for the two lengths of pipe, which should be shipped from the shop in the proper lengths. The lower section, or roof sleeve, should be provided with several projections which will just allow the sleeve to slip over the pipe and at the same time steady it. This roof sleeve should be set after the pipes are in position. The roofing felts should be cleared of gravel and coated with a hot cement in which the sleeve should be firmly bedded and tightly bolted through the roof boards. The joints and the tops of the flanges should also be well coated with this cement. The sleeve should not be less than four inches in height and there should be at least one-half inch clearance between the sleeve and the umbrella. Galvanized sheet iron is generally used in this work, but this is frail and easily damaged. Whenever the safety valves are taken off for repair, the light galvanized iron work usually becomes so badly injured that it is unfit for further use. If the sleeve and umbrella be made of cast iron they will stand abuse and furthermore will be inexpensive.

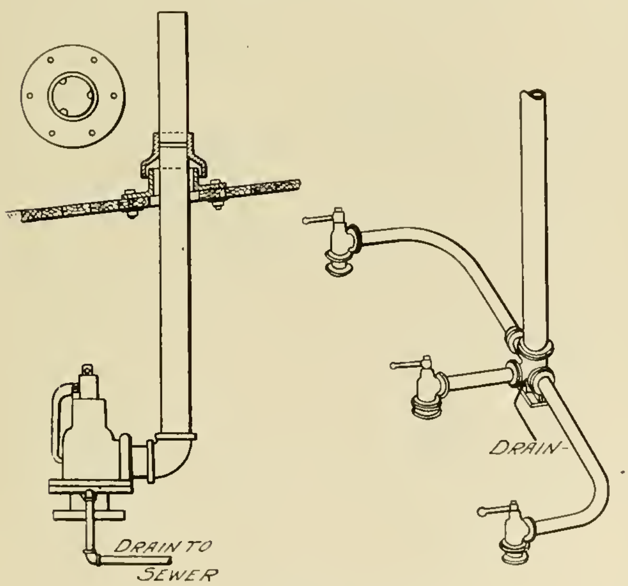


FIG. 128-(A30-1) AND FIG. 129-(A30-2).

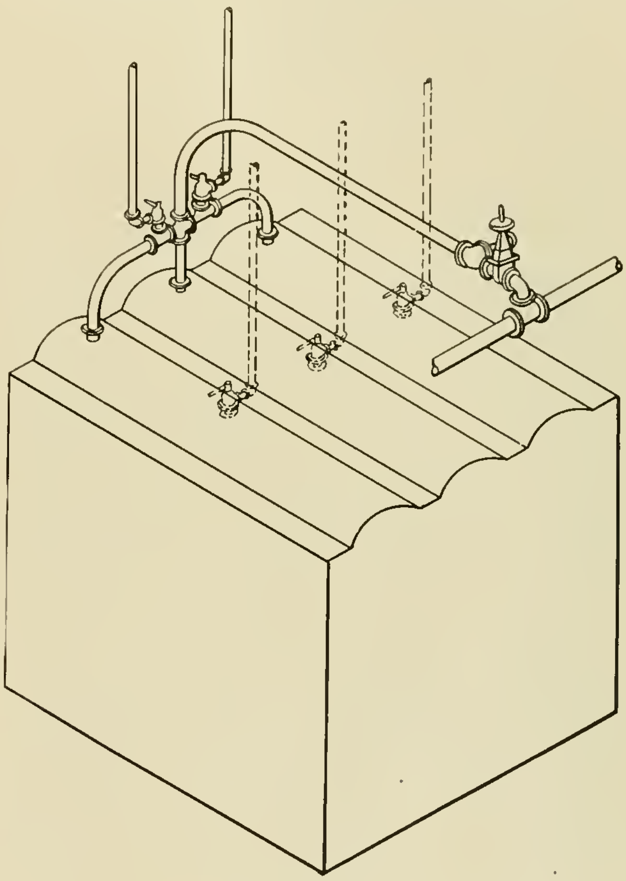


FIG. 130-(A30-3).

Attention should be given to the safety valve drain. This opening should be free to the atmosphere at all times, as much damage results if water or condensation is allowed to remain in the valve and cause water hammer when the steam is escaping. A rule should be enforced that only the discharge from safety valves on boilers that are commonly shut down at the same time should be tied into a common pipe line. It is quite imperative that this rule be observed, as boiler insurance companies will not allow gate valves in safety valve branches, and without gate valves in the safety valve branch connected to more than one working boiler, the operator would be liable to serious injury when making repairs. If but one boiler at a time is shut down for cleaning, then but the two or three valves on that boiler should be tied into the one line to the atmosphere. If the plant has a number of boilers which are shut down in batteries of two, then the safety valves on

these boilers may be discharged into a common main. In most cases it is better to tie in only the discharge pipes from the one boiler, and if the roof is not over 20 ft. above the safety valve, it will be found less expensive to run separate pipes. The tie should be made far enough away from the safety valve to allow for expansion, and the side outlet foot tee should be provided with a drain as shown in Fig. 129-(A30-2). The foot tee should have a substantial support to enable it to carry the weight of the stand pipe

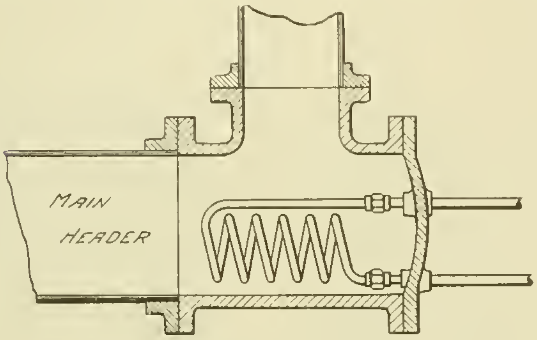


FIG. 131-(A31-1).

and its branches so that a valve can be removed without causing any severe strain.

The arrangement shown in full line in Fig. 130-(A30-3) is not considered good practice. The safety valves should not be taken off such pipe lines as have just been described or from that portion of the boiler where steam is on its way to the pipe main. They should be placed where there is the largest volume of steam. The steam flowing through the pipe line does not flow with a uniform velocity. The variation in pressure at the boiler connection may be as much as five pounds when steam is being delivered to a large slow-speed engine. This fluctuation of pressure exists in all the steam lines as well as in the boiler, but since there is such a large steam volume in the boiler, the pressure there is not noticeably affected. In the pipe line this variation is very perceptible, and its amount may be determined by placing an engine indicator on the lines and moving the drum slowly, allowing the pulsations to indicate a diagram which will resemble the teeth of a saw. When the safety valves are subjected to this pulsating pressure they will chatter if the pressure is close to the blow-off point. If the safety valves are set for a drop in pressure of three pounds, the pulsating pressure due to the engine cut-off is sufficient to run the pressure up to the blow-off point after which it drops almost instantly to the closing point, so that by synchronous pulsation with the engine the valve will make from 150 to 200 beats per minute or twice for each engine revolution. One minute's wear occasioned by this beating is equal, possibly, to a month's wear due to ordinary service. To secure the proper wear the safety valves should be separated from the steam connection as shown by the dotted lines in Fig. 130-(A30-3). This may be done if provision is made when the boiler contract is let.

Steam for Heating Purposes.

Steam connections to heat water for the lavatory should be avoided whenever possible, as numerous difficulties are thereby occasioned. A coil can be attached to a blind flange at the end of a header through which the water to be warmed may pass as is shown in Fig. 131-(A31-1). In order to avoid generating steam when but little water is being used, the water should pass to the coil at boiler pressure. After leaving the coil, the water should pass through a pressure reducing and a relief valve before reaching the plumbing fixtures. When high pressure and high temperature water is reduced in pressure by passage through a reducing valve, it will partially evaporate in the low-pressure line, thus causing water hammer and very unsatisfactory water service.

A very satisfactory method for heating low-pressure water with steam of a higher pressure is shown in Fig. 132-(A31-2). The heating coil, a, takes steam through the valve, b, which is controlled by means of the thermostat tube, c. The thermometer, d, shows the temperature of the water, which can be altered by changing the set of the valve stem at the sleeve, e. This sleeve is similar to a turn-buckle having lock nuts as shown. The post, f, is made of a solid bar which assists in holding the valve securely and prevents springing. Water is fed in at g and passes out at h. The lower end of the coil is open, which allows the steam drips to discharge into the warm-water receiver, j. In case an unusually large temporary demand is made on the heater, the steam will flow through the coil and into the water direct. In regular operation, the coil should be partly filled with water.

Wherever possible, steam connections should be so arranged that conductors will not be exposed to lower temperatures than that of the roof. If it is necessary to locate conductors outside of the building, this cannot be effected and the only thing to do is to supply the conductors with either exhaust or live steam. If the plant is operated condensing, it is quite probable that all the exhaust steam from the auxiliaries will be condensed in the heater. The openings into conductors should be quite small. For this purpose about a ⅜-in. pipe with the valve inside the wall should be used and it should be drained into the conductor as shown in Fig. 133-(A32-1). The lower section, a, should be of cast iron. The upper portion of the conductor may be made of galvanized iron and the sewer of tile. The small pipe should pass through a 1½-in. pipe sleeve built in the wall. This is a somewhat extravagant use of steam but it is less expensive than the frequent renewing of conductors. In general the roofs of power stations are quite flat and are not exposed to any extent to the wind. For this reason, they are usually very warm even in the coldest weather, but conductors placed on the outside of buildings will usually freeze unless heat be admitted to them. Some saving may be effected by the use of high temperature drains. A system that will discharge vapors into sewers so that the vapors will pass through the conductors, will usually cause as much damage by rusting out the conductors as would be occasioned by freezing. The best arrangement that can be made with outside conductors is to use live steam only when needed.

Live Steam to Low-Pressure Cylinder.

In many cases, a live steam connection to the low-pressure cylinders is furnished by the engine builder. This connection may be either a warming pipe or a steam line to the low-pressure side

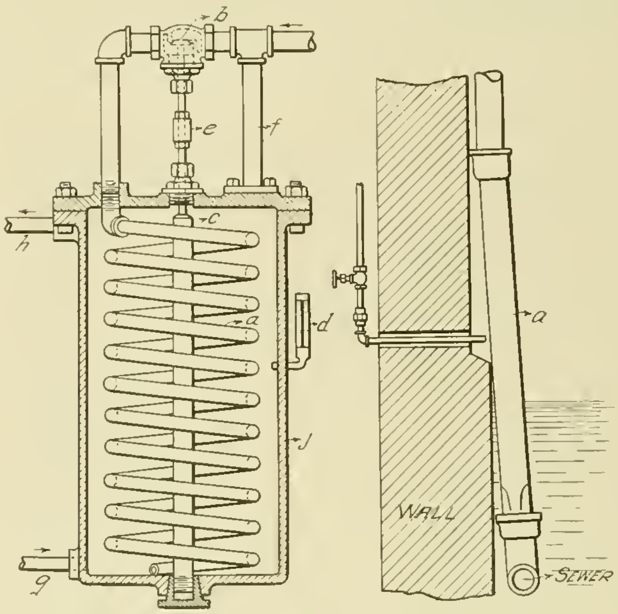


FIG. 132-(A31-2) AND FIG. 133-(A32-1).

to be used when the low-pressure side is run independent of the high-pressure side. There are cases where it is good policy to arrange a cross-compound engine so that the low-pressure side can be run without the high-pressure side. Ordinarily this detail is found necessary when the plant has been arranged with but one or two large engines. In such cases there is no reserve provided and in order to enable the plant to operate, it is necessary to use the half of the engine that is in order. There are also certain instances where it is good practice to lay out a plant with but one or two engines. This would be the case when the original installa-

tion is to be increased within a short time by the addition of engines of the same size, as by this means the use of small and large engines in the same plant is avoided.

A suitable arrangement of piping is shown in Fig. 134-(A33-1) whereby the high-pressure side can be exhausted to the condenser or to the atmosphere, or the low-pressure side can take steam through the reducing valve, a, and be protected by the relief valve, b, set at about 25 lb. The small valve, c, is the by-pass for warming up the low-pressure side. The valve, d, which shuts off the condenser should be motor operated if it is larger than 20 in. The atmospheric valve is shown at e and the main steam throttle at f. The horizontal valves are used only when changing over these connections and should not be fitted with operating stands on the engine-room floor as they are not used often enough to warrant the additional expense or the extra floor space which they take up. The high-pressure throttle, f, the low-pressure throttle, g, the by-pass, c, and the electric buttons for the valve, d, are the only operating devices which are necessary on the engine-room floor.

This system of piping to both the high and low-pressure cylinders is frequently carried to an extreme. In stations having three or more units, it is useless to complicate the piping with the extra parts required. If an engine is out of order the operator will invariably shut down the entire unit, notwithstanding the fact that it may be piped to run on either side. There are many plants piped in this manner that have never made use of the arrangement, and there are cases where it would seem that they would certainly find it to their advantage to use this piping system rather than shut down the entire unit. For stations having a large number of units, it is the better practice to provide the simplest possible arrangement that will insure the best protection of the entire unit as a whole. Straight connections from one opening to another should be avoided as continuous trouble with the joints is almost certain to result.

Fig. 135-(A33-2) illustrates the "straight-line connection" which is used by a number of engine builders. This connection is difficult to make and so little provision is allowed for expansion that severe strains are placed on the joints under the cylinders. Such strains should be relieved as much as possible in order to avoid the necessity of frequent renewal. These joints are so situated that

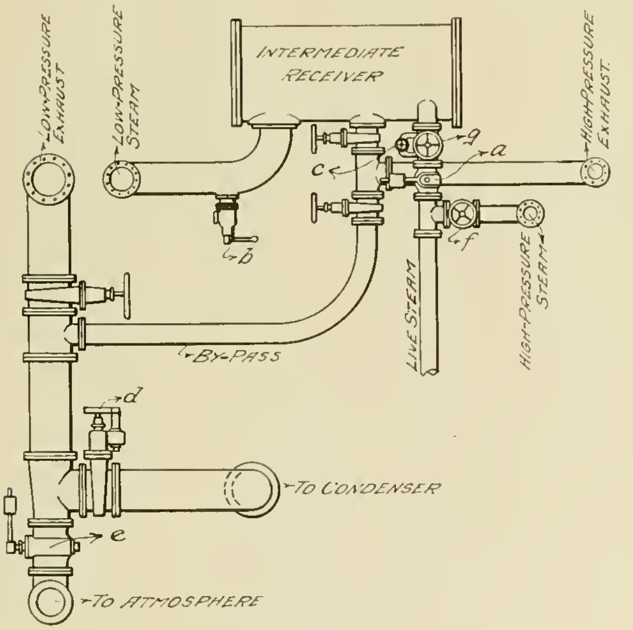


FIG. 134-(A33-1).

it is quite difficult to make a connection that will stand ordinary strains and therefore when subjected to the strains of the piping as shown in Fig. 135-(A33-2) a great deal of trouble will result.

The use of a warming pipe for low-pressure cylinders is not universal with corliss engine installations. It is possible to send steam through the high-pressure cylinders to the receiver without the use of a separate warming pipe. Before the engine is started steam should be blown through the steam valves in and out of the cylinder and through the exhaust valves on both sides of the piston. This is possible with any engine having a release connection at the end of the valve rods and a lever for rolling the valves by hand. When a warming pipe is used, the steam is discharged into the intermediate receiver or one of the pipe connections through a small pipe, say a 2-in. pipe for a 2,000-h. p. engine, with the valve stem run through the floor and fitted with a stand. If the valve gear is not provided with a releasing device, it is advisable to run a warming line to the intermediate connection between the high and low-pressure sides, so that the low-pressure side will have

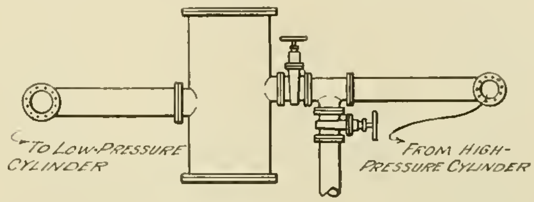


FIG. 135-(A33-2).

steam when the engine starts to roll over. In case steam is taken from the header above the engine having a branch to the throttle over the high-pressure cylinder, the low-pressure live steam connection should be effected from a separate branch from the header. This will simplify the piping arrangement.

Steam connections to engine cylinder jackets are not ordinarily required, the general practice being to furnish the engines without jackets. Where the jackets are not furnished, the steam to and the drips from the jackets are under full boiler pressure and the drips are returned to the boiler through a return system similar to that used for the other drips in the plant. In order to discharge these drips together with other drips of boiler pressure the jackets used must be of ample size to avoid any perceptible pressure loss due to the small size of the pipe connections.

There is but one important requisite in the steam connection to the live steam purifier which is to deliver steam to the purifier at a pressure sufficient to permit water to flow by gravity to the boilers. If the purifier is mounted at a sufficient height above the boilers

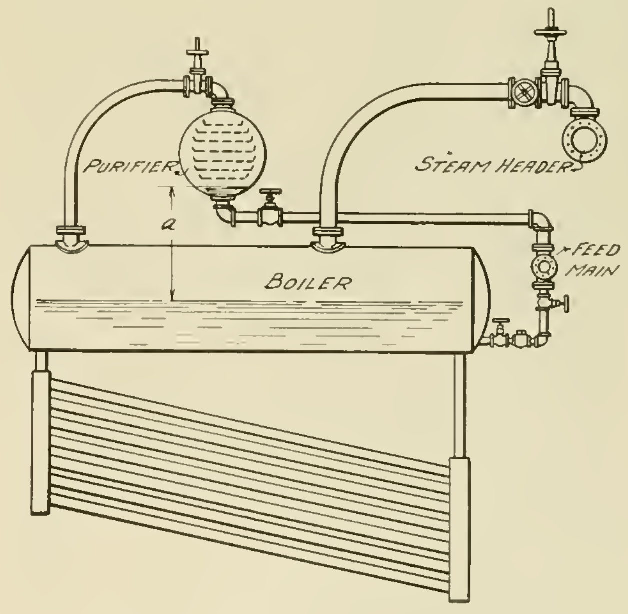


FIG. 136-(A34-1).

to allow a loss in steam pressure before delivery to the purifier, the steam branch may be run from the header. A good method of piping when the purifier is placed but a few feet above the boilers is shown in Fig. 136-(A34-1). If three or four boilers are supplied by the purifier, the branches can be run into a main which has a single connection to the purifier or the three or four branches may be separately run to the purifier with a valve in each branch. The water column, a, indicates the head at which

water is to be delivered to the boiler. This head must be greater than the combined losses of the steam flowing through its branches to the purifier, the loss in the head of the water flowing from the purifier to the boiler, the loss in the head of the water passing through the check valve, and the loss in the head in the main steam header as measured at the different boiler branches. These losses could scarcely be measured on a gage reading to 165 lbs. of steam, but when considered in connection with the head, a, that pressure may be sufficient to prevent a flow to the boiler. When a is four or six feet there can be but very slight losses. In fact

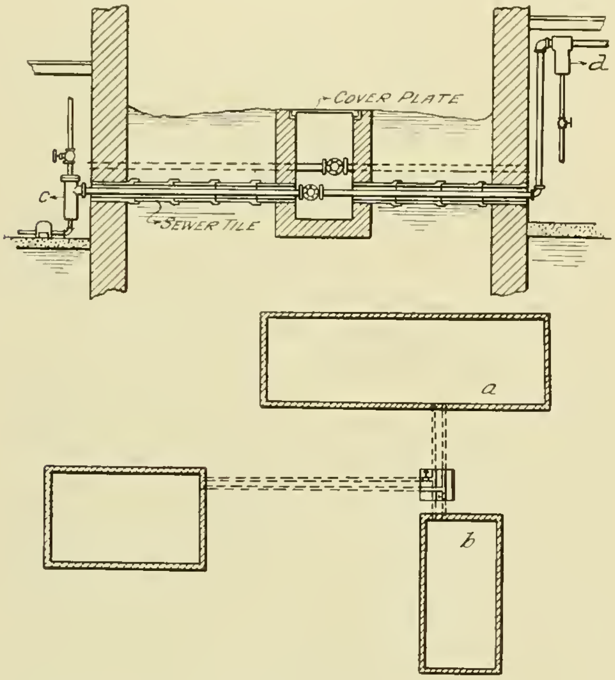


FIG. 137-(A36-1).

the combined losses previously mentioned would be less than three pounds per square inch. These losses should be calculated for not less than three times as much water and steam flowing as the boiler rating would indicate, in order to permit bringing the water up to its proper line while the boiler is being crowded.

An inexpensive and satisfactory method of running supply lines to other buildings for driving machinery, heating, etc., is shown in Fig. 137-(A36-1). The piping is run through tile and if a straight run cannot be made from the one building to the other, a well is placed at the intersection to enable a line that is out of order to be disconnected. The lines should be located so that they can be drawn back into the room at least the length of the pipe, enabling the removal of the entire line without disturbing the ground. If the building, a, will not permit drawing the pipe into it, the line from the building a. to the building b, may be drawn through into the building b. The steam separators, c and d, are so placed that they will take care of the condensation. The pipes in the tile should be left bare and the air space closed by a man-hole cover with the end openings at the walls plugged with asbestos. The tile should be cemented at the joints and, if convenient, the well should have a drain to the sewer. What little moisture would work into the tile or well would be quickly evaporated.

(To be continued.)

Sub-Station Emergency Repairs.

BY H. C. REAGAN.

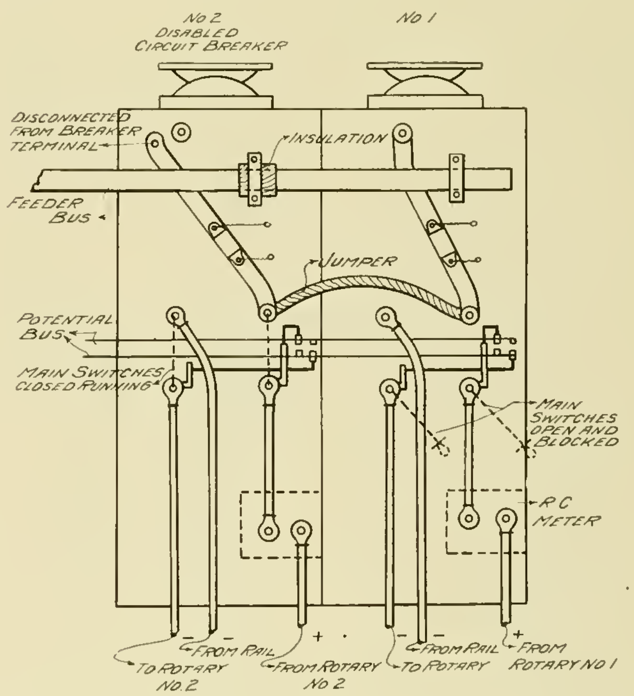
The unexpected will happen in a sub-station just as it will wherever electrical machinery is used, and the rapidity with which any defect can be remedied and serious delays prevented is of mutual advantage to the operator and the company. In time of accident, if duplicate parts are not at hand for speedy renewal, the resources and ingenuity of the operator will then be called upon to make the repairs and prevent serious delay.

It may be interesting to relate the details of a sub-station switchboard accident which happened on a western railroad system where the writer was responsible for the continued operation of the electrical machinery. This sub-station contained two rotary transformers with machine panels for each rotary and three feeder panels. At the time of the trouble rotary No. 1 was undergoing some repairs, thus leaving rotary No. 2 to care for the entire service. The system fed by this sub-station was subject to severe electrical storms and during one of these storms the lightning jumped to ground in the circuit-breaker of the No. 2 machine, causing the supplementary terminals and springs to be fused and thus destroyed by the arcing of the current from the rotary. This necessarily rendered rotary No. 2 unable to furnish its usual current to a very important section of the line.

The writer was summoned to this sub-station where he quickly took note of the situation. There were no extra circuit-breakers close at hand and as the traffic demanded an immediate supply of current he proceeded to make the repairs shown in the accompanying sketch. On the back of the panel of the No. 2 rotary, the bar leading from the upper terminal of the positive main switch to the circuit-breaker terminal was disconnected and fastened in the position shown by the sketch. The clamp on the other terminal of the circuit breaker was insulated at its bus-bar connection by placing pieces of dry wood on both sides of the bar and tightening the clamps so that they would hold the wood securely in place.

When the No. 2 circuit-breaker had thus been disconnected a jumper made from some heavy cable was used to connect the upper terminals of the positive main switches on both panels. In order that no mistake might occur, both main switches on panel No. 1 were thrown open and blocked.

With the connections made as just described it is seen that all the instruments on panel No 2 were in use except the disabled



EMERGENCY SWITCHBOARD REPAIRS.

circuit-breaker, and that the jumper allowed circuit-breaker No. 1 to be used in place of No. 2. The path of the current was from the main switch on panel No. 2 through the circuit-breaker on panel No. 1 to the feeder bus from which it was fed to the line through the uninjured feeder panels. With these repairs it is seen that an idle piece of apparatus was placed in use and current soon furnished to the line. While this scheme for repairs is a simple one, it shows what can be done in an emergency.

The power house, car barns and ten interurban cars of the Canton-Akron Traction Co. at Canal Dover, O., were recently destroyed by fire.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Kenfield Publishing Co. under the title "Street Railway Law," five volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901 to 1903; Vol. V. from April, 1903, to August, 1905. Price: Bound in sheep; five volumes, $12.00; single volume, $3.00. Bound in buckram; five volumes, $8.00; single volume, $2.00.]

BURDEN OF PROOF WHERE PASSENGER IS INJURED IN COLLISION WITH WAGON.

Chicago Union Traction Co. vs. Mee (Ill.), 75 N. E. Rep. 800. Oct. 24, 1905.

In a case where a passenger is injured by a collision between the car in which he is riding and a wagon upon the street, the supreme court of Illinois holds that there is no presumption in favor of the negligence of the company, so as to throw upon it the burden of proving that it was not negligent. On the contrary, the burden of proof is upon the plantiff to show that the company was negligent

POSITION TO BE TAKEN BY ONE WAITING FOR CAR—BEING STRUCK ON HEAD.

Neale vs. Springfield Street Railway Co. (Mass.), 75 N. E. Rep. 702. Oct. 19, 1905.

It is the duty of a person intending to enter a car upon a highway, the supreme judicial court of Massachusetts says, to take a position outside the reach of an approaching car; for it is common knowledge that a car usually passes a person who has signaled it to stop, so that he may enter by the rear end. In this case, the plaintiff, standing in a space about 2 feet from the rail, where the snow had been scraped off by the plow so as to be substantially level with the track, and beyond which was a ridge of snow about 18 in. high, was, while leaning his head forward, struck on the head by some part of the car. The court holds that he was not in the exercise of due care, and, therefore, not entitled to recover damages.

WHAT A MOTORMAN MAY PRESUME AND SHOULD DO, SEEING A PERSON APPROACHING THE TRACK.

Eckhard vs. St. Louis Transit Co. (Mo.), 89 S. W. Rep. 602. Oct. 25, 1905.

The supreme court of Missouri, division No. 2, says that it is of the opinion that, if the conduct and actions of a party approaching a railway track would lead a person of ordinary prudence, who might be operating a car upon said track, to conclude that such party was going upon the track, the right to act upon the presumption that the person would stop before going upon it ceases. A motorman has the right to act upon the presumption that a person approaching a railway track upon which he is operating his car will stop before undertaking to cross the track, so long as there is nothing in the conduct and actions of the person so approaching as would indicate to a man of ordinary prudence that he was not going to stop, but was going to cross the track. Upon the observance of such conduct and actions on the part of a person approaching a railway track as would indicate that he intended to go upon the track, it is clearly the duty of the motorman to pursue such course in respect to the operation of that car as he would if he was in fact aware that the person was going to get on the track.

LIABILITY FOR INJURY FROM INSUFFICIENT INSULATION TO EMPLOYE OF ANOTHER COMPANY DOING CONTRACT WORK IN POWER HOUSE.

Ryan vs. St. Louis Transit Co. (Mo.), 89 S. W. Rep. 865. Oct. 25, 1905.

When the defendant company made its contract with a heating company to install an oil system in its power house upon plans and specifications prescribed by itself, the supreme court of Missouri, division No. 2, holds that it knew and was bound to anticipate the necessity under which the heating company rested of sending its employes upon its premises for the purpose of installing the pipes upon which one of its employes was working when he was killed; and hence the duty devolved upon the defendant of keeping the electrical wires near which such employe was required to work in the performance of his duty in installing the oil pipes so insulated and protected as to be safe for the employe to work in their vicinity. The fact that there was no direct contractual relation between the employe and the transit company would not prevent a recovery by his widow, in view of the highly dangerous character of the electric wires about which he was required to work. The insistence of counsel that the accident was one which the company could not have reasonably anticipated, and therefore was not bound for its failure to keep the electric cables properly insulated, was without merit.

A PASSENGER CONTINUES SUCH WHILE ALIGHTING—CARE DUE FROM CARRIER—PRESUMPTION OF NEGGIGENCE.

Cody vs. Market Street Railway Co. (Cal.), 82 Pac. Rep. 666. Oct. 11, 1905.

There can be no question, the supreme court of California says, that the relation of carrier and passenger continues to exist while the passenger is expeditiously engaged in the act of carefully and prudently alighting from the car, and that the carrier is bound to exercise the same high degree of care in affording a passenger a reasonable opportunity to alight in safety as in carrying him safely. If a passenger, while alighting with due care from a car, is injured by some act of the carrier in operating the car, a presumption of negligence on the part of the carrier at once arises. Proof of such facts causes the case to fall within the rule that: "When a thing which causes injury is shown to be under the management of the defendant, and the accident is such as in the ordinary course of things does not happen, if those who have the management use proper care, it affords reasonable evidence, in the absence of explanation by the defendant, that the accident arose from a want of care." The rule has been held applicable in cases of passengers entering upon and alighting from street cars. Of course the mere fact unexplained that such a person was injured while entering or leaving a car would raise no such presumption.

SUFFICIENCY OF ALLEGATIONS AS TO BANANA PEELING HAVING BEEN LEFT ON FLOOR OR CAR.

Dallas Consolidated Electric Street Railway Co. vs. Black (Tex. Civ. App.), 89 S. W. Rep. 1087. Nov. 1, 1905.

The petition in this case against the company alleged that the defendant negligently left a banana peeling on the floor of the car between the seat on which the plaintiff was sitting and the one immediately in front of her, and in the hurry to get off the car she did not see said banana peeling, and did not know it was there; she stepped upon it, and it caused her to slip, etc.; and furthere alleged that it was the duty of the company to keep the floor in clean condition, etc. The court of civil appeals of Texas says that these averments were sufficient. It was an allegation to the effect that the defendant company left the banana peeling upon the floor of the car. If this was true, and that was an act of negligence, and it was the cause of the plaintiff's injuries, she was entitled to recover damages. If the banana peeling was left there by some one else than the company or those charged with the duty of operating the car, then it would have been necessary to have alleged the neglignce in that particular in suffering the banana peeling to remain on the floor of the car a certain length of time; but if the company or

those in charge of the car, who rested under the duty of exercising that high degree of care towards its passengers, left the banana peeling there, the company would be liable, whether it was averred or shown that it remained there any certain length of time or not; provided leaving a banana peeling there under the circumstances would be negligence.

NOT REQUIRED TO BUILD PLATFORM OR CROSSING ON LEVEL WITH RAILS AT STOPPING PLACE WHILE STREET IS BEING REPAVED.

Sweet vs. Detroit United Railway (Mich.), 105 N. W. Rep. 132. Nov. 7, 1905.

A street was being repaved. The south side, including one track of the defendant's trolley line thereon, was completed. The concrete had been laid under the other track and the remainder of the roadway. So far as appeared, this concrete foundation was perfectly smooth, and was the width of a paving brick, and possiblly a little more, below the top of the rails. The plaintiff, starting to cross the tracks to take a car, slipped, caught his foot under the flange of the rail, and fell between and upon the rails of the northerly track. This was at or near a stopping place indicated by a small tin sign. Negligence was charged in that the defendant did not maintain temporary crossings and platforms or other safe means to enable people to take the cars at this station or abandon the station. But the supreme court of Michigan says that it might eliminate the question as to the platform, because the plaintiff was not injured for want of a platform. He was crossing the track when he slipped. The testimony indicated a smooth path, except for the rail, and the plaintiff, with full knowledge of the situation, was willing to cross the track and take the car at this point. The court agrees with the circuit judge that it was not negligent for the street railway to omit building a platform or a crossing on a level with the rails. The public is not entitled to such unusual care as was urged in this case. It was apparent to every one that the rail would have to be stepped over, and it was reasonable that citizens should be asked to do so under the circumstances. The plaintiff knew the necessity and acquiesced, but had the misfortune to fall down. It was a casualty, the consequences of which he must suffer, and which there was no justice in asking others to bear the burden of.

RELATIVE RIGHTS AND DUTIES OF COMPANY AND INDIVIDUALS IN STREETS—ATTEMPTING TO CROSS TRACK IN FACE OF DANGER—NO HARD AND FAST RULE FOR ALL CASES—ATTEMPTING TO CROSS WITH FOUR-HORSE TEAM WHEN CAR A BLOCK AWAY.

United Railways & Electric Co. of Baltimore vs. Watkins (Md.), 62 Atl. Rep. 234. Nov. 23, 1905.

A street railway company, the court of appeals of Maryland says, has no exclusive right to the use of a public highway in a city for the movement of its cars, and possesses no greater or superior right to use the street than is enjoyed by any individual, apart from the mere franchise to lay its rails thereon. That franchise in no way exempts such a company from an imperative obligation to exercise due and proper care in propelling its cars to avoid injuring persons who have an equal right to use the same street as a thoroughfare. Inasmuch as the right of the individual to use the street is coextensive with the like right of the railway, each, as a consequence, owes to the other precisely the same duty to avoid an injury, and the railway company has no more right carelessly to run its cars along its tracks than the individual has carelessly to cross or traverse them.

When the facts show, as in some of the cases they have shown, that the injury had resulted from a deliberate, but unsuccessful, effort to cross the track in the face of evident danger, or when the disaster had been due to a miscalculation as to the chances of the individual being able to clear the track before the car would reach the point where the collision coincidentally occurred, a recovery has been denied upon the obvious ground that such a reckless attempt was gross negligence on the part of the person injured. Whilst each party, the driver of the team and the railway company, had an equal right to use the highway lawfully, neither was justified in using it in such a way as to imperil the safety of the other, and the individual who disregarded his own safety by rashly undertaking to cross the track when no prudent man would venture to do so was in no position to hold the company answerable for the consequences of his own heedlessness or folly. In the very nature of things, no hard and fast rule can be laid down by which every case of this character can be measured, and therefore the ultimate conclusion reached in one controversy cannot necessarily control the final decision of some other similar, though not precisely identical, contest.

No such postulate has even been announced or could be accepted, if asserted, as that no one who may be driving a four-horse wagon in the city can prudently cross the tracks at intersecting streets whilst a street car coming towards him is as near as the distance of a block from the point of crossing. The mere fact, then, of attempting to cross over the street car tracks in a city when an approaching car is no nearer than just indicated cannot be considered an act of negligence.

RISK ASSUMED BY FOREMAN GOING BETWEEN STALLED CAR AND WALL OF BARN.

Laffan vs. Metropolitan Street Railway Co. (N. Y. Sup.), 95 N. Y. Supp. 705. Nov. 10, 1905.

A car entering a barn lost its momentum and came to a full stop on the curve leading into the barn. It was then three or four feet away from a partition or wall of the barn. A foreman at work at the barn being notified of this situation, gave orders for leaders to be attached to the platform of the car, and when they were adjusted he gave instructions to go ahead; but the car did not move. He then walked forward in the space between the car and the partition, and as he did so the car moved and he was crushed. His administratrix claimed that she was entitled to recover damages because of faulty construction and of negligence of the company in not furnishing a safe place for the man to work in. But the first appellate division of the supreme court of New York says that it was quite apparent that he knew all about the situation, and that he assumed the risk of his own action in undertaking to go into the space between the car and the partition. He undoubtedly did not suppose the car would move, but that was a risk he took upon himself. Cars requiring repairs were constantly run into this barn, and he must have known all about the condition and situation of such cars. The court does not think that it could be said to be negligence on the part of the company that it did not provide for such an extraordinary occurrence as that a car should stop on a curve, and that one of its employes, in the effort to move it into the barn, should put himself in a condition in which he could be crushed between the car and some part of the building. But be that as it might, it was obvious that this man knew everything about the situation, and that he acted in view of that knowledge and condition, taking the responsibility upon himself.

RISK OF BEING THROWN FROM CAR BY DERAILMENT DUE TO DEFECT IN TRACK UNKNOWN TO CONDUCTOR NOT ASSUMED BY HIM—ROUGHNESS OF TRACK AND KNOWLEDGE OF PREVIOUS MOTORMAN OR GIVING WARNING OF BEING LATE NOT EVIDENCE AGAINST CONDUCTOR.

Osterhout vs. Jersey City, Hoboken & Paterson Street Railway Co. (N. J. Sup.), 62 Atl. Rep. 190. Nov. 13, 1905.

A conductor was thrown from the platfrom of a trolley car and injured. It appeared that he knew that the track was rough and uneven, but it did not conclusively appear that he knew or should have known of other defects on the track, which probably caused the derailment. The supreme court of New Jersey holds that, in an action against his employer, the court rightfully refused to nonsuit or direct verdict for the defendant, asked for on the ground that the plaintiff assumed the risk of derailment of the car. It says that the risk of injury from a defect in the track, negligently permitted to remain unrepaired, was not one of the ordinary risks which the conductor assumed in entering upon his employment. He could not be said to have assumed the risk, in the absence of notification of the danger, unless the danger was so apparent that by a person in his position, using reasonable prudence, it would have been observed. The fact that the track was rough and uneven,

and by reason thereof the joints may have been uneven, did not prove that the risk of derailment was apparent. Nor, from the fact, if true, that a previous motorman had observed conditions which warned him of the danger, did it follow that this conductor should have observed the same conditions. A motorman's attention is directed to the line of the track over which he is passing, but a conductor has other duties which demand his attention elsewhere. A warning given by the conductor to the motorman that they were five minutes late could not be regarded as a direction to run over this portion of the track at a reckless speed.

RIGHT OF CONSTRUCTION COMPANY TO LIEN GIVEN PERSONS FOR WORK OR LABOR.

Tennis Brothers Co. vs. Wetzel & Tyler Railway Co. (U. S. C. C., W. Va.), 140 Fed. Rep. 193. Aug. 22, 1905.

Section 7 of chapter 75 of the code of West Virginia of 1899 provides that, "Every workman, laborer or other person who shall do or perform any work or labor, by virtue of any contract for any incorporated company doing business in this state, shall have a lien for the value of such work or labor," etc. The United States circuit court says that it can see nothing in the statute restricting this lien law to an individual. Furthermore, the court holds that what a corporation contracted to do was "work or labor" in the meaning of this statute, where it undertook to hire the labor, supervise the grading, the trestle and bridge work, the laying down of the rails, and numerous other things in connection with the construction of an electric railway, being primarily liable to pay all labor bills, supply all tools, and to be wholly under the direction and control of the railway company's supervising engineer. The court says that it would seem clear that this could be nothing else than work and labor under contract. It would likewise reasonably appear plain that the manner of arriving at the compensation to be paid for this labor by the terms of the contract would be immaterial. It might have provided for a fixed gross sum, for a sum based upon the number of men employed and the days of work required. It did provide that the compensation for this labor should be arrived at by taking a per cent amount of the outlay made in accomplishing the work. There was also a clause providing for one-half of this compensation to be paid in bonds. These bonds, if tendered promptly, would, to the extent at least of one-half the amount, have destroyed the right to this laborer's lien, because their payment period ran far beyond that in which the lien could be filed and enforced by suit. But this method of payment under the contract was clearly optional with the railway company, and it was not accepted. No bonds so far as disclosed were ever issued, certainly not tendered to the plaintiff corporation, and the right to do so might well be assumed to have been abandoned. Therefore, this ground of defense to a suit to enforce said lien must fall.

POWER COMPANY MAY BE COMPELLED TO CONTINUE FURNISHING POWER IN PUBLIC INTEREST.

Seattle Electric Co. vs. Snoqualmie Falls Power Co. (Wash.), 82 Pac. Rep. 713. Oct. 14, 1905.

Where a power company had a contract to furnish electricity to another company engaged in the business of conducting street railways and of supplying electricity for lighting and power in a city, and the court found that the latter company did not have sufficient facilities under its own command to enable it to operate sufficiently the public conveniences operated by it, the supreme court of Washington holds that there was no error in holding as a matter of law that the power company, which had, without notice, cut the connection between its generator and the other company's power plant, could be compelled to furnish the power it had contracted to furnish until the other company could with reasonable diligence acquire such facilities, and that this was so notwithstanding that the contract violated a franchise provision by containing an agreement that no electric current should be sold in the city by the power company to be used in any branch of business in which the other company was engaged.

The company to be furnished the power appearing from the evidence not to have been entirely free from blame in its contract, the court says that it was proper to inquire whether it could have performed the public duties required of it without the aid of the power furnished it. And the court thinks that the evidence reasonably justified the conclusion that it could not, in as much as, while it may have had sufficient facilities for generating power to have carried the load required of it even at its most extreme point, it was made clear that this is not sufficient to constitute a safe working basis. Machinery, no matter how perfectly made, will get out of repair, and it is found that to furnish power for continuous use there must be a reserve force equal to the largest unit used in generating such power. This the company did not have, and its claim that power from the power company's power plant was necessary to secure an uninterrupted service, seems to have been justified.

Conceding that the power was necessary, there could be no serious dispute over the question of law involved. While courts of equity will not enforce contracts entered into either in violation of positive law or a rule of public policy where the interests of the parties thereto are alone involved, yet when the public interests are involved, it will enforce such a contract as long as such public interest requires it.

INJURY TO CONDUCTOR FROM MOTORMAN OF ANOTHER CAR HAVING IMPROPER HANDLE—FELLOW SERVANTS — DUTY TO FURNISH REASONABLY SAFE CARS AND ALL NECESSARY PARTS—LIABILITY FOR NEGLIGENCE OF BARN MAN.

Chicago Union Traction Co. vs. Sawusch (Ill.), 75 N. E. Rep. 797. Oct. 24, 1905. Rehearing denied Dec. 6, 1905.

A conductor, who desired to let down the fender on the rear end of his car, was caught between that car and the one behind it, owing to the motorman on the latter car having too large a handle so that when he attempted to back that car he unintentionally made it go forward instead. The cause of the motorman's having the wrong handle was his having changed from one car to another sent out from the barns to replace it on account of something having gone wrong with it. Now, the contention that the motorman and the conductor were fellow servants, the supreme court of Illinois says, might be conceded. The barn man, who took out the second car to the motorman, however, was clearly not a fellow servant of the conductor. The barn man was chosen by the master to select the car to be sent to the motorman and to take it out on the line of the road and there deliver it to him. He was therefore, while engaged for the master in supplying to the motorman a car, performing a duty which devolved on the master to perform.

It was the duty of the company, the court continues, to furnish the cars to be operated by its servants. The law charged upon it the positive obligation to furnish reasonably safe cars and with no necessary part omitted therefrom, and holds it responsible for any failure to discharge that obligation and makes it liable for the failure of any servant it may employ to discharge that obligation. Any servant so employed is engaged in the performance of a duty or obligation of the company, and is acting as the representative and agent of the company, and for any want of proper caution on the part of any such agent or representative the company is liable as for its own personal negligence. The neglect to perform that duty by such a representative or agent of the master is not a peril which other servants of the master assume.

The court thinks it clearly deducible from the proof, either that the barn man and representative of the company delivered to the motorman the car which he brought from the barn with the improper handle thereon, or that he delivered the car without any handle on it. If the handle remained on each car when the cars were changed, then the barn man, the representative of the company, delivered a car supplied with an improper handle, and this negligence was that of the company and was the cause of the injury to the conductor. If, when the cars were changed, each motorman carried with him the handle from the car he was operating, then the barn man delivered to the motorman a car without any handle, which was a negligent act on the part of the company and the proximate cause of the injury to the conductor. It might be that it was fairly to be deduced also from the evidence that the motorman, if he had exercised due care, would have discovered that the car which was delivered to him by the barn man was operated by a different and smaller motor requiring a different and

smaller handle than the car he had been operating, and the injury received by the conductor may have been, in part, chargeable to this lack of due care on the part of the motorman, a fellow servant. But if the negligence of the barn man, who was the representative of the company and whose negligence was its negligence, contributed to the injury, and the injury would not have occurred but for the lack of care of the barn man, the company would be liable.

DUTY OF DRIVERS OF VEHICLES EMERGING FROM INTERSECTING STREETS TO LOOK AND LISTEN ALTHOUGH A RULE REQUIRES CARS TO KEEP A CERTAIN DISTANCE APART.

Dewez vs. New Orleans Railways Co. (La.), 39 So. Rep. 433. Rehearing refused Nov. 6, 1905.

Persons emerging from streets which are intersected by others upon which electric cars are operated are bound, in common caution, the supreme court of Louisana holds, to look and listen for the approach of such cars before attempting to drive across the tracks, and, though there may be a rule, imposed upon its employes by the railroad company, that its cars shall keep a certain distance apart, the precaution mentioned should nevertheless be observed, as the mere fact that a car has passed will not justify the driver of a vehicle in acting upon the assumption that no other is near, when the contrary would become known by the ordinary use of his eyes or ears.

The court says that it was not specifically informed as to the purpose of the rule referred to, and, in the absence of explanation upon the subject, concluded that it concerned rather the convenience than the safety of the public, and that its enforcement must depend upon varying conditions. Thus, if one car should get out of order, so as to be unable to move with its own apparatus, it could not be supposed that another would not be allowed to push or trail it to its destination; or, if one car should be delayed by an obstruction, or by taking or discharging an unusually large number of passengers, the court should hardly imagine that it would be a violation of the spirit of the rule that another, the motorman of which was instructed to make schedule time, should close up, momentarily, within the prescribed distance. But, however that might be, and assuming that in the case at bar the colliding car had violated the spirit, as well as the letter, of the rule, the court is unable to concede that the plaintiff was therefore at liberty to close his eyes and ears, and, because the car was where it ought not to have been, drive into it, or into a position where a collision with it was unavoidable.

And where a milk cart and an electric car, moving upon lines which intersected each other almost at right angles, collided in such a way as to show that the points of contact were the right shaft of the cart and the left front umbrella post of the car, the court holds that it should not be said that the car ran into the cart, any more than that the cart ran into the car.

PRESUMPTION OF NEGLIGENCE FROM COLLISION OF CARS—CARE REQUIRED—FAILURE TO PROVIDE FOR LOCKING OF SWITCH—CONDITION OF CARS AFTER COLLISION EVIDENCE OF SPEED.

Elgin, Aurora & Southern Traction Co. vs. Wilson (Ill.), 75 N. E. Rep. 436. Oct. 24, 1905.

Proof that the latter-named party, by whom this action was brought, was a passenger, that the car in which she was riding collided with another car, and that she was injured, no negligence appearing on her part, the supreme court of Illinois holds, made a prima facie case of negligent failure on the part of the company to discharge the duty it owed to her, and entitled her to recover damages for the injuries sustained by her, unless the company, by proof, should acquit itself of the presumption that the collision was in some way occasioned by its failure to discharge its duty as a public carrier to her, as its passenger.

The doctrine to be deduced from a number of Illinois cases, it says, is that, when one becomes a passenger on a car of a common carrier to be transported from one station on its line to another, and has paid consideration therefore, the contract on the part of the carrier is to provide safe and sound cars, track, and necessary appliances to carry the passenger to his or her destination without injury. Where such a passenger is injured by a collision, proof of the relation of passenger and carrier, of the collision and the injury, if no contributing negligence on the part of the passenger appears, makes a prima facie case for the resulting damages, and casts upon the common carrier the burden of proving that the injury resulted from inevitable accident or from some cause against which human prudence and foresight could not have provided.

A failure of the company to provide some means for locking a switch arm or lever, or to have some one to prevent the disarrangement of an appliance so easily rendered dangerous to its passengers, was justly regarded by the court as a failure on its part to perform its obligations and duty to those who had entrusted themselves to its care as a public carrier. That a collision was caused by the tortious act of a stranger could have no effect to relieve the common carrier from responsibility to an injured passenger, if the failure of the carrier to do that which human foresight and forethought would have suggested presented the opportunity for the commission of the tortious act.

Evidence as to the condition of the cars after collision was admissible. The manner in which the cars were driven together and broken and damaged, as shown by the proof, tended to support the view that the car in which the passenger injured was riding was moving at a very great rate of speed.

TIME UNDER STATUTE FOR OBTAINING CONSENT AND VALIDITY OF CHARTER TO SECOND COMPANY.

Nanticoke Suburban Street Railway Co. vs. People's Street Railway Co. of Nanticoke and Newport (Pa.), 61 Atl. 997, June 22, 1905.

The Pennsylvania act of June 7, 1901, requires for even the inchoate exclusive right to occupy the streets that "The consent of the local authorities shall be promptly applied for, and shall have been obtained within two years from the date of the charter." The supreme court of Pennsylvania holds that an application within the two years will prima facie meet the statutory requirement of promptness, unless the circumstances indicate a want of bona fide intention to obtain consent at all. And it says that it must follow that the company, nothwithstanding a refusal, is entitled to the full period to overcome objections. Consequently the statutory grant of two years in which to obtain the municipal consent is not shortened by an earlier refusal.

Section 1 of the act of 1901 provides: "No other charter to build a road on the same streets*** shall be granted to any other company within the time during which the company first securing the charter has the right to commence and complete this work." It is the view of the court that the provision as to any second charter is not a mandatory prohibition under all circumstances, but is directory only, for the protection of prior rights, and to prevent the commonwealth from doing a vain thing by the grant of a charter which would be illusory and misleading. But if the circumstances show that the act would not be vain, as, for instance, if the first company had within the two years abandoned its route, or in any way the rights had ceased which the statute was designed to protect, the prohibition would no longer have any purpose to serve, and might be disregarded.

On the other hand, the court says that it is entirely in accord with the intent and policy of the statute that a second company should be allowed to put itself, so far as practicable, in position to step into the place, should the failure of the first leave it vacant. Of course, the presumption is in favor of the first charter, and nothing can be permitted to be done to interfere with it by seekers after a second place. The statute prima facie prohibits a second charter during the running of the first; and, should one for any reason be issued, it will be set aside on quo warranto. But, where the first lapses, the newcomer next in position may step into place. Thus, in this case, when the second company in question started its proceedings to extend its route the two years allowed the first company were nearing the close, and the borough had twice refused consent. While there was still time for a possible change of the municipal mind, yet the presumption was that consent would not be given, and that the first company's charter would fail. There was nothing in the circumstances, therefore, to impugn the good faith of the second company, and when the prior charter did in fact lapse, the second company was first in the field.

The Petaluma & Santa Rosa Railway.

Including a Description of the Operating and Dispatching Systems.

BY E. E. DOWNS, GENERAL MANAGER.

The Petaluma & Santa Rosa Ry. is fast proving its worth as a developer of the Gold Ridge territory of California, of which Sebastopol is the center. The line serves the rich and densely populated portion of Sonoma county lying west of the California Northwestern Ry., and reached by but one branch of that road.

The company is operating a passenger and freight system between San Francisco, Petaluma, Sebastopol, Forestville and Santa Rosa, of which 37 miles is handled by a steamboat line. All freight given the electric line for shipment to San Francisco is taken to Petaluma and from there carried by two steamers owned by the railway company, which make daily trips between Petaluma and San Francisco. The electric railroad has its own wharf at the foot of Market St., San Francisco, and has leased under a 10-year contract the warehouse and canal at Petaluma, thus controlling the principal part of the water front of the city.

The length of the electric line is 36 miles, of which about 26 miles are on private right-of-way. The railway runs from the water front at Petaluma to Sebastopol, a distance of 16.7 miles, and from Sebastopol an extension has been recently completed to Forestville, a distance of eight miles. There is also a branch in operation from Sebastopol to Santa Rosa, a distance of six and one-half miles.

FREIGHT AND PASSENGER STATION AT FORESTVILLE.

The roadbed is constructed with 70-lb. rail and ballasted throughout with broken stone, the maximum curvature being 10 degrees and the maximum grade 2 per cent. An overhead trolley system is used, the current being supplied by the California Gas & Electric Co. under a 10-year contract. This company has a power station at Petaluma and the railroad company has erected a large stone station at Sebastopol, in which the power company has placed its own machinery. From this building current is distributed for the operation of the entire system.

JUNCTION AT SEBASTOPOL—PETALUMA & SANTA ROSA RY

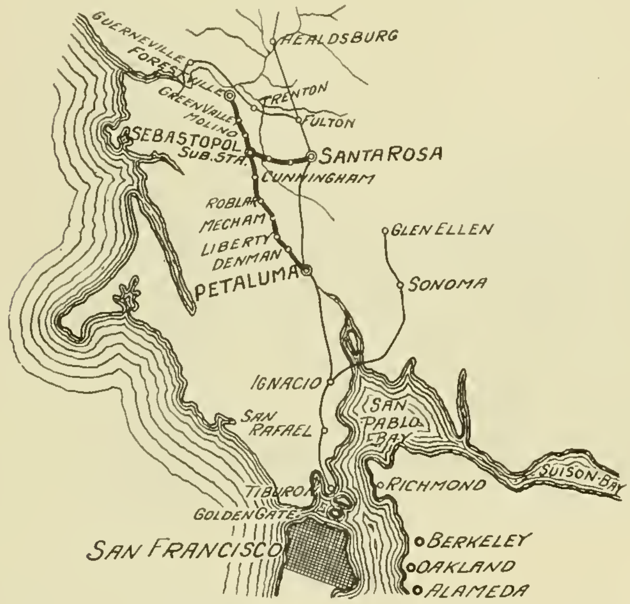
The rolling stock consists of 10 semi-convertible passenger cars built by the American Car Co. of St. Louis. These cars are of an unique and excellent design. The special features include a center

vestibule and side doors which give direct entrance from either side of the car to both passenger and baggage compartments, thus keeping the ends of the car free from the swing of the truck and obviating the necessity of passengers entering or leaving through the motorman's cab.

The passenger compartments accommodate 40 passengers and have seats 36 in. long, upholstered in cane. The interior finish of the cars is of inlaid mahogany. At the end of the passenger compartment, next the entrance doors, is a special form of water cooler suspended from the ventilator or rail close to the end so that it does not interfere with the passengers. At the bottom of the cooler a drain pipe serves as a support.

The baggage compartment is finished in mahogany and is furnished with folding seats for the use of smokers. A screen door closes the opening when the baggage door is open, and when the door is closed the screen acts as a protection to the woodwork of the side of the compartment. The vestibule is guarded on either side by high folding gates.

The length of the car body is 46 ft. 1 in., and over bumpers, 47 ft. 9 in.; width over sills, including sheathing, 8 ft. 8 in. The center sills are composed of 7-in. I-beams, with yellow pine fillers. The



MAP OF THE PETALUMA & SANTA ROSA RY.

steps are 15⅞ in. from the rails. The cars are mounted on Brill No. 27-E2 trucks having 6-ft. wheel bases, 33-in. wheels and equipped with motors of 40-h. p. rated capacity.

Other than the passenger cars the equipment includes 70 flat and box cars, 5 freight motor cars and one express car.

Operating Department.

All agents, dispatchers, trainmen, warehouse employes and trackmen report to the superintendent and form a part of the operating department. The car house employes and linemen report to the electrical engineer. The agents at the different stations keep in close touch with the superintendent and general freight and passenger agent and report to them daily anything of interest to the company as well as the need of cars for special parties, freight cars for special shipments, etc. Agents also forward a daily yard report, as shown in Fig. 1, stating the number of cars in the yard or at spurs or side tracks under their jurisdiction, the condition of the equipment and the kind and number of cars they are liable to need for the next day's business. Conductors forward a daily yard report of all cars along the line where there are no agents. Cars are required to be unloaded within 48 hours after arrival at their destination.

A car slip, Fig. 2, or way-bill, Fig. 3, must accompany all cars, and be delivered to the agent at the destination. If there is no agent they are sent to the next station where there is one. Way freight that is unloaded along the line is checked off by conductors, and such freight is always required to be prepaid if billed to a place where there is no agent. Express matter is handled on both freight and passenger cars. Small packages are accepted on all passenger cars, the handling of large and bulky articles being restricted to certain passenger cars and to freight trains.

Flag stations are supplied with white flags and shipping receipt blanks, which are filled out by the shipper. The conductor makes out a copy of this receipt and leaves the orginal with his signature

LOCOMOTIVE WITH FREIGHT TRAIN.

for the shipper, showing that the shipment was regularly accepted for transportation. The shipper also places the white flag in the socket on the station building, which is a signal for trainmen that there is freight at the station for transportation.

The length, width and capacity is marked on all freight cars. The cars vary from 15 to 20 tons capacity and are loaded not to exceed 10 per cent overweight. It is the duty of the agents and operating department to endeavor to obtain the highest average tonnage per car mile. A mileage report, Fig. 4, of all cars is turned in daily by conductors. This report includes freight and passenger motors and freight cars, the record of the mileage being kept, as well as the tonnage hauled on each car.

Freight cars are, when practicable, kept at stations along the line after they are unloaded until they are loaded for the return trip. This condition prevails at large stations, but is not very often the

FREIGHT LOCOMOTIVE—PETALUMA & SANTA ROSA RAILWAY CO.

case at smaller ones. The proper place and proper time to remove or leave empty cars is quite a problem, as it is often impossible to foresee where cars will be required. With close attention, however, it very seldom occurs that empty cars are unnecessarily taken over the road. For the movement and supply of empty cars a regular form of train message is used.

For the record of chartered or special cars a regular form of special car order, as shown in Fig. 5, is made out and kept on file

until the trip has been made, a duplicate copy being also sent to the accounting department. There is also a printed form for car mileage. Way-bills accompany all shipments and freight car slips accompany cars not provided with way-bills. Shipping receipts are made out by agents, conductors or shippers, and are signed by the company's employe who accepts the shipment. Yard reports are forwarded by agents and conductors at the close of each day's work

A daily record of conductors' receipts is kept on the trip sheet, Fig. 6, which is turned in at the expiration of the run together with the amount of cash, etc. The Ohmer twelve-fare register is

PETALUMA AND SANTA ROSA RAILWAY CO.

YARD REPORT

Santa - Rosa Station

Date Dec. 11, 1905

Car Number Load	Car Number Empty	Condition	Lbcetrp ov Trace No	Destination
38		O.K.	1	Santa Rosa
42		O.K.	2	" "
	27	O.K.	3	----

CARS NEEDED

Date Dec. 11, 1905. 190

Flats --- Sideboard Flats 1
Box 2 Stovewood Car -
Stock ---
Fruit ---

Brown, Agent

FIG. 1. YARD REPORT. (ORIGINAL 3½ X 7 IN.)

Petaluma & Santa Rosa Railway Co.

FREIGHT.

CAR SLIP

From Mills.
To Petaluma
Car 32
Date Dec. 11, 1905.
Contents Dried Fruit.

This Car Slip must always accompany the Car through to destination, the Way-Bill having been sent under cover. If from any cause, the Car is left on the Road, this Slip must remain with the Car. The Conductor will note below the cause of detention, and also report facts, by 'Phone from nearest office, to the Superintendent or Train Dispatcher.

Conductors are positively forbidden to take into their Train any loaded Car without a regular Way-Bill or Car Slip.

E. E. DOWNS, General Manager

CONDUCTORS WILL SIGN HERE

W. Jones.

FIG. 2. SLIP ACCOMPANYING CAR-LOAD SHIPMENT. (ORIGINAL 4 X 7½ IN.)

used, which records all payments of fare of a cash value. A record of free transportation is also kept. The name, number of pass, and the points from and to which the person presenting the pass is riding, are recorded in the spaces for that purpose. Time cards are turned in daily, are checked up by the dispatcher and in turn forwarded to the accounting department. For the destination of pas-

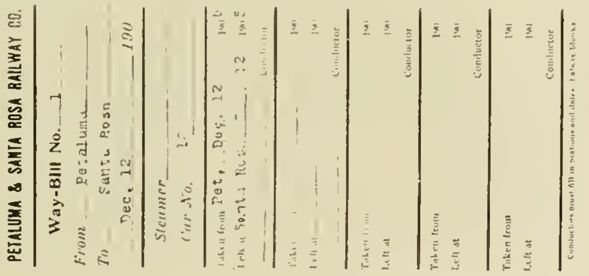


FIG. 3A. OUTSIDE OF WAY-BILL WHEN FOLDED. (ORIGINAL 3½ X 7 IN.)

nects all terminals, offices, principal side-tracks, and sub-stations of the company. In addition to the instruments there is a shelf and a supply of blank forms of train orders and clearance cards in the telephone booths. Locked deposit boxes are also placed at all telephones, to which boxes the superintendent only has access.

There are two forms of train orders and clearance cards, that is, tissues and carbon backs. The tissues are used by the dispatcher and the carbon backs at stations along the line. A Western Union observatory clock is kept in the superintendent's office and all

PETALUMA AND SANTA ROSA RAILWAY COMPANY

FREIGHT CAR MILEAGE

Date Dec. 12, 1905

Car No.	FROM	TO	Miles
42	Petaluma	Sebastopol	16.65
36	Sebastopol	Santa Rosa	6.17
37	Santa Rosa	Petaluma	22.82
32	Sebastopol	Petaluma	15.65

Con. Jones Train 506.

FIG. 4. DAILY FREIGHT CAR MILEAGE REPORT. (ORIGINAL 4¼ X 6¼ IN.)

motormen and conductors are required to compare their watches with the clock every 24 hours and to sign on the train register in the space reserved for that purpose at the time of comparison.

All trainmen who have the handling and care of trains must be in good physical health, have unimpaired eyesight and hearing, must carry a watch of standard make, certified to on a written form by the company's jeweler, and must pass required examinations in regard to rules, bulletins and time tables.

Train registers are located at terminals and junction points and must be signed and checked up by the conductors. All regular trains appearing on the time table operate entirely independent of the dispatcher, unless lack of power or other causes delay them. All extra trains are handled by written train orders from the dispatcher. Trains are divided into three classes, the first class being known as regular passenger, the second class as regular freight, and the third class as extra passenger or extra freight trains. All inferior trains must keep seven minutes off the time of superior trains.

For the movement of all extra trains or for orders affecting reg-

F. 3 (2-11-05 10m) Copying Ink

Petaluma & Santa Rosa Railway Co. Petaluma, Dec. 11, 1905 190

Car No. 18 Steamer -- Train No. 201 From Petaluma to Santa Rosa W. B. No. 1

Consignor	Consignee and Marks	No. Pkgs	ARTICLES	Weight	Rate	Freight Charges	Back Charges	Prepaid Charges	Prepaid Beyond
John Doe	Jones	30	Wheat	3500#	$2.00	$3.50	--	--	--
W. Brown	Smith	20	Flour	2000#	$2.00	$2.00	--	--	--

FIG. 3. FREIGHT WAY-BILL. (ORIGINAL 14 X 3½ IN.)

sengers, conductors use hat checks. All lost articles are turned into the superintendent's office tagged with a special tag.

Dispatching System.

The dispatching is done by telephone, the instruments including wall, desk and portable car phones. A single telephone line con-

ular trains, the agents at different stations are pressed into service in order to facilitate matters, but in most cases the conductor receives the train order direct from the dispatcher. The meeting or passing points of all regular trains are indicated on the time tables in full-faced type and all meeting point of trains of the same class are absolute, that is, such meetings are made according to time

table without any variation of time allowance unless otherwise ordered by a special train order.

Train orders are numbered consecutively beginning at midnight, the date, etc., being placed on all blanks in the space provided for

SPECIAL CAR ORDER

Date Dec. 11, 1905.

LEAVE Petaluma at 7 P. M.

FOR

Santa Rosa

RETURNING

LEAVE Santa Rosa at 1 A. M.

FOR

Petaluma

John Smith *in charge.*

Ordered by Agent Jones.

Charges $25.00

FIG. 5. SPECIAL CAR ORDER. (ORIGINAL $5\frac{1}{2} \times 7$ IN.)

that purpose. They are addressed to those who are to execute them. The "X——Opr:" means that the party receiving the order is ready to proceed with the transmission of the order and that the train therein mentioned will be held until such order is

RECORD OF FREE TRANSPORTATION

Terminal	Time	Name	Annual Pass No.	Emp. Pass No.	Badge No.	Trip Pass No.	From	To

PETALUMA AND SANTA ROSA RAILWAY CO.

Date Dec. 8, 1905

Conductor Jones Key No. 509

" Time 6:00 A. m 6:00 P. m 12 Hours

Motorman Smith m m

Motorman 6:00 A. m 6:00 P. m 12

Car 51 Crew No. 1

CASH $30.00

5	TICKETS AT	5c		25
10	"	10c	1	00
	"	15c		
5	"	20c	1	00
2	"	25c		50
3	"	30c		90
	"	35c		
	"	40c		
	"	45c		
	"	50c		
	"	55c		
	"	60c		

Total Tickets 25 Am't $ 3.65

Extra Baggage $

Total Earnings $33.65

FIG. 6. PASSENGER CONDUCTORS' DAILY REPORT—OUTSIDE. (ORIGINAL $7 \times 7\frac{1}{2}$ IN.)

completed. The time that the "X——Opr:" answers is then placed on the order and the message desired is read aloud by the dispatcher to the operator or conductor. The dispatcher writes the order on a blank form, the same as the conductor or operator does. Conductors or operators, unless otherwise ordered, take three manifold copies. The operator or conductor then repeats the order to the dispatcher, who, if it is repeated correctly, will announce the following: "Supt.'s Signature. Repeated O. K. at —— Time. Conductor Train ——. Made complete at ——. Dispatcher's name"; after which the order is in force and the train can proceed. If the person receiving the order is other than the one who is to execute it, the "Supt.'s Signature. Repeated O. K. Made complete," etc., will not be given until such person has repeated the order to the dispatcher.

The "complete" of an order means that the person who is to execute it has received, repeated and understands the order so completed. If

SHIPPING RECEIPT. No. 1

PETALUMA & SANTA ROSA RY.

Dec. 12, 1905

RECEIVED this day by the PETALUMA & SANTA ROSA RY. of

Robler

Wm. Jones Shipper

AGENTS MUST SEE THAT PLACE AND DATE ARE DULY FILLED IN

CONSIGNEE, MARKS AND DESTINATION

John Smith

230 California St.,

San Francisco.

No. Pkgs.	ARTICLES	WEIGHT
4	Eggs	
6	Potatoes	
2	Chickens	

Conductor R. Doe.

PETALUMA AND SANTA ROSA RAILWAY COMPANY

TRAINMEN'S TIME CARD

Date Dec. 12 1905

CLASS OF SERVICE	Motor No.	Miles	Time On	Time Off	Hours	Min.
Freight	6	70	8:45A	9:00P	12	15
Total					12	15

Conductor

Motorman John Smith.

Brakeman

Helper

FIG. 8. TRAINMEN'S TIME CARD. (ORIGINAL $4\frac{1}{2} \times 6$ IN.)

FIG. 7. SHIPPER'S RECEIPT (ORIGINAL $4\frac{3}{4} \times 3\frac{1}{4}$ IN.)

through any cause crews exchange trains or are relieved before their orders are executed they exchange orders, in which case the conductor exchanging must repeat the orders to the dispatcher and receive the "complete" in regular form. If the crews change at a non-telephone station, the order must be repeated at

RECORD OF PASSENGERS REGISTERED

Car 51 No

Train	Time	Passengers	Train	Time	Passengers
101	6:00A	5			
102	7:30A	15			
103	10:30A	10			
104	12:00P	20			
105	1:30P	50			
106	2:45P	10			

Total Passengers 110

Trips at miles, miles

Trips at miles, miles

Trips at miles, miles

Total Miles 182

RECORD OF FREE TRANSPORTATION

Train	Time	Name	Annual Pass No.	Emp. Pass No.	Badge No.	Trip Pass No.	From	To
101		John Smith	200				Petaluma	Santa Rosa
103		W. Jones		42			Sebastopol	Santa Rosa
103		John Doe				42	Sebastopol	Santa Rosa

FIG. 6A. PASSENGER CONDUCTORS' DAILY REPORT—INSIDE. (ORIGINAL $7 \times 7\frac{1}{2}$ IN.)

the first telephone. Train orders are in effect until finished, annulled or superseded. The conductor deposits the third copy of all orders or clearance cards in the deposit box for the future refer-

ence of the superintendent. He then hands a copy to his motorman, reads his own to him and allows the brakeman to read the order also.

Clearance cards are issued to a train that has been ordered to report, after it is found that no train orders are necessary; the same action being taken as regards regular train orders. In case a train has orders to report at any station and the telephone line fails,

PETALUMA AND SANTA ROSA RAILWAY COMPANY

MEMORANDUM WORK ORDER

—FOR—

Conductor Jones *Train* 205

At Sebastopol. *Date* Dec. 11, 1905

Please carry out the following Work Order as far as practical on this date

Car No.	On Track	Station	Set in at	On Track	MEMO.
24	2	Seb.	Forestville	1	To load hops.
27	3	"	GreenValley	1	" " wood.

—AND ALSO—

Pick up three empty flats at Green Valley and take to Forestville for reserve.

By order of John Doe, *Supt.*

Per Smith, Dispatcher

O. K. Jones. Con. Train 205.

FIG. 9. MEMORANDUM WORK ORDER. (ORIGINAL 5⅜ X 8⅜ IN.)

it can not proceed until a clearance permit is brought on some regular train or until the telephone line is again clear. Train orders have no meaning unless completed in regular form. An order is never completed to an inferior train until the order is completed to the superior train. All trains report if they become five minutes late after the current has been off. Superior trains are not allowed to make up time after the current has been off to avoid meeting inferior trains which have been delayed under circumstances they could not avoid and which may keep them from making a certain point to meet the superior train. Copies of all train orders and clearance cards are kept on file by the dispatcher and a record of all extra trains is kept on the train sheet, as well as unfinished business, the state of the weather, the location of linemen, section men, etc.

Personnel.

The officers of the Petaluma & Santa Rosa Railway Co. are: President, J. A. McNear; secretary, Thomas Archer; treasurer, Burke Corbet; auditor, H. Roe; general manager and purchasing agent, Edwin E. Downs; superintendent, E. E. Thornton; chief engineer, Walter Coleman.

Ottawa Electric Railway Co. Annual Report.

The annual report of the president and directors of the Ottawa Electric Railway Co., has been submitted to the shareholders in the form of a tastily bound pamphlet. The balance sheet shows that the gross receipts for the year were $449,633, an increase of $63,694 over the receipts of the previous year. During the 12 months ending Dec. 31, 1905, there were 9,891,311 passengers carried at a net yearly profit of $143,876. The ratio of operating expenses to the receipts was 54.4 per cent, and during the year the bond interest was paid, four quarterly dividends of 2 per cent and a bonus of 2 per cent were distributed and $23,000 was placed to the credit of the contingent account to be applied to the reduction of track renewal, car equipment accounts, etc.

The Detroit, Monroe & Toledo Short Line Ry. Issues an Attractive Folder.

The Detroit, Monroe & Toledo Short Line Ry., which is an almost air-line connection along the shore of Lake Erie between Detroit and Toledo, has recently issued a very attractive folder which includes a time table, the rates of freight, a very complete map of the line and considerable general information. A very complete description of this line was presented in "The Street Railway Review" for January, 1905. The company has about 70 miles of track and a considerable portion of the line has been double-tracked. The distance between the centers of the cities of Detroit and Toledo is 56 miles. The company has outstanding a capital stock of $2,500,000 and a bond issue of a like amount. The service which the company provides compares favorably with that of other interurban roads of that section and its roadbed and equipment are in accord with the service.

The company maintains an hourly schedule, the cars making the run between Detroit and Toledo in two hours and thirty minutes. The cars leave Detroit on the half hour, commencing at 6:30 a. m., and leave Toledo on the hour, commencing at 7:00 a. m. On or about April 1st, a limited parlor car will be operated between Detroit and Toledo, stopping only at Wyandotte and Monroe and making the run in two hours. On this car, every passenger will have a chair and an additional charge of 25 cents per passenger will be made. Connections are made with all interurban lines running out of Detroit and Toledo and close connections are made with all limited cars out of Detroit on the Detroit, Ypsilanti, Ann Arbor & Jackson Ry.

An efficient baggage and freight service is operated. Two cars are run each way daily which carry trunks and suit cases. Freight is carried on special freight cars, giving an express service at freight rates.

The company has a branch line running from Monroe to a resort on Lake Erie known as Monroe Piers, which is located about four miles from Monroe. The beach at this point on Lake Erie is very fine and during the past summer more than 100,000 people are said to have visited the place. Besides the bathing facilities, a number of amusement devices are operated, such as merry-go-rounds and roller coasters and there is also a casino, a dancing pavilion and a good hotel. During the summer season, the cars run from the city of Monroe to Monroe Piers every 20 minutes and from Toledo, every 30 minutes. The annual yacht races of the Monroe Yacht Club are held at this place, making it attractive to the people who are interested in yachting.

The Annual Conventions of the Iowa Electrical Association and the Iowa Street & Interurban Railway Association.

The annual convention of the Iowa Electrical Association will be held at Des Moines, Ia., on April 18th and 19th. The annual convention of the Iowa Street & Interurban Railway Association will be held at the same place April 19th and 20th, the two conventions overlapping one day and consuming three days. The Kirkwood Hotel has been chosen as the official headquarters of both conventions. Indications point to the probability that the conventions will be more successful than any yet held. A number of prominent men will be in attendance, among whom Governor Sherman of Illinois and Governor Cummins of Iowa are expected.

The street railway association has arranged for papers on "Standard Car and Track Construction for Street and Interurban Work," "Discipline of Car Service Employes," and "The Comparative Value of the Alternating and Direct Current Systems of Distribution for Railway Work," with discussions on the merits of the two types of motors. The association is also endeavoring to obtain a paper on "Gasoline Engines for Interurban Service" and it will also have several papers on "Rail Bond, Field and Armature Testing."

The program of the electrical association is an ambitious one and it is expected that much benefit will be derived from the papers to be read and from the discussions which it is hoped they will incite. The list of contributors and subjects is as follows:

J. R. Cravath, Chicago, Ill., "Report on Progress;" D. F. McGee, Red Oak, "Facts and Factors;" Frank B. Rae, Jr., Detroit, Mich.,

subject to be announced; C. F. Freehauf, Cresco, "Economy of Mechanical Stokers and Ash Machinery in Small Stations;" W. A. Mall, Belle Plaine, "Economy of a Condensing Plant in Small Stations;" L. W. Gill, Manchester, "Effect of Boiler Compounds on Engine Lubrication;" J. A. Innes, Eagle Grove, "Line Losses and Economical Distribution;" A. W. Zahm, Mason City, and H. G. Gorr, Dubuque, "Care and Maintenance of Meters;" C. E. Stanton, Dubuque, and Niels Christensen, Waterloo, "Some Practical Experiences with Steam Turbines;" H. G. Gorr, Dubuque, Thomas Sloss, Cedar Rapids, and W. P. Casper, Keokuk, "Experiences with Grounded Secondaries;" J. P. Jones, Cedar Falls, F. H. Richardson, Boone, W. J. Greene, Cedar Rapids, and J. Walsh, Davenport, "Effect of a Day Load on Station Economy;" Prof. George D. Shepardson, Minneapolis, Minn., subject to be announced; W. S. Mead, Parkersburg, O. E. Brownell, Lake City, Jos. Hutchinson, Manchester, and Thomas Ferris, Osage, "Ways and Means of Increasing Business in Towns under 5,000;" Prof. G. W. Bissell, Ames, "Depreciation of Electrical Properties." Hon. L. Y. Sherman, lieutenant-governor of Illinois, Springfield Ill., "Unreasonable and Unrestrained Rate Agitation;" George McLean, Dubuque, "Equitable Rates;" Mr. Hurd, attorney-at-law, Dubuque, "Legal Status of Rate Regulation;" Hon. M. J. Wade, Iowa City, "Political Status of Rate Regulation."

Through its secretary and treasurer, L. D. Mathes, general manager of the Union Electric Co., of Dubuque, Ia., the street railway association extends a hearty invitation to the trade to attend the convention, the same invitation being extended by Austin Burt of Waterloo, Iowa, the preseident of the electrical association.

East Lake Park.

PHOENIX RAILWAY CO.

The Phoenix Railway Co. operates a park at the eastern end of its line which is known as East Lake Park, and is located about a mile and a half from the center of the city of Phoenix, Ariz. The park has a theater, which is managed by Chas. F. Berger. The building has a seating capacity of about 500 and a performance is given each evening during the week. A variety of entertainment is presented and the theater has been quite successful. There is also an artificial lake, in the center of which is a small island. The boating and fishing on this lake are very good. The park also contains a large athletic ground.

The Special Car of the Inter-Urban Railway Co. of Des Moines, Ia.

Several interurban roads have recently put into service special cars which they rent to private parties and which also do service as private cars for the railway officials. These cars are, as a rule, of a particularly fine type of construction, are fitted with every convenience and compare favorably with cars of a similar type in use on steam roads. Such a car is the "Iowa" of the Inter-Urban Railway Co. of Des Moines, Ia., which, through the courtesy of President Polk, we are pleased to describe.

The car was constructed under the personal supervision of the company's master mechanic, J. E. Welch, in the shops of the Des Moines City Railway Co. The plans were prepared by F. S. Cummins, the chief engineer. The "Iowa" has an over-all length of 46 ft. and an over-all width of 8 ft. 7 in. It includes an observation platform 5 ft. 8½ in. in length, an observation room 15 ft. 7 in. in length, a dining room 10 ft. 4 in. in length and a motorman's cab 3 ft. 6½ in. in length. The remainder of the 46 ft. is taken up by the passageway, lavatory and kitchen. The sills are of 8-in. I-beams filled in with 2-in. pine into which the posts are mortised. The framing is also of steel I-beams.

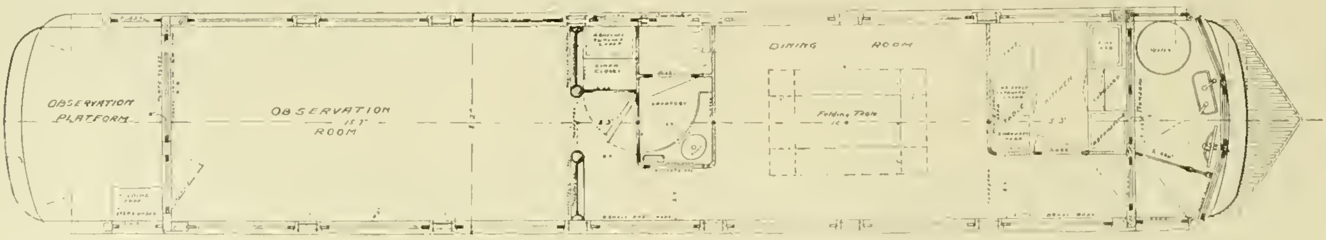
The outside coloring of the car is a royal blue with silver trimmings, the window sashes and doors being a natural mahogany

INTERIOR OF DINING ROOM.

and the metal work of polished brass. All glass in the outside windows is a heavy plate except the oval window in the lavatory and the transom windows, which are of opalescent art glass. The steps are of extra heavy steel fitted with a carborundum safety tread. Entrance to the motorman's cab is made by means of a ladder step.

The woodwork of the interior, including the ceiling, is of curly birch, stained a light mahogany. The paneling is of a simple but effective design. The shades throughout the car are of an olive green color, having a leather exterior and a silk interior.

The observation platform is of sufficient size to seat six people in the small folding chairs constructed of birch and stained to match the woodwork. When not in use, these chairs are stored in a compartment provided for them above the lavatory. The observation platform has its floor covered with rubber matting and is entirely enclosed by an ornamental brass railing. A door space is provided on either side of the platform, the one on the right being used in entering the car from the ground, while the one on the left is a blind panel. Only one passenger entrance was included in the design so that in order to stiffen the frame a continuous channel could be run with the body of the car from one end to the other on one side.



PLAN VIEW OF THE SPECIAL CAR "IOWA."

The color scheme of the observation room is a rich olive green.

The carpet is a body brussels in a green pattern with small dark figures. Green wicker armchairs, fitted with cushions of the same color, are provided. A small round table finished the same as the woodwork completes the furniture of this room. Tapestry curtains are hung over the rear windows and in the opening between the observation room and the passageway to the dining room. A pleasing effect is added by full-length plate mirrors placed on each side of the door to the dining room. An ornamental iron and art glass electric lamp is provided for illuminating the table in the observation room. Two folding card tables of natural mahogany are available, but usually are stored in a special compartment above the lavatory.

SPECIAL CAR "IOWA" OF THE INTER-URBAN RAILWAY CO. OF DES MOINES, IA.

The carpet and draperies in the dining room are of a deep red color. The table is of mahogany, 2 x 4 ft. in size with a heavy square leg at each corner. The size of the table top can be increased by adding a section to any or all of the sides. When all the sections are in place, the size of the top is 4 x 6 ft. There are 12 chairs of the same wood as the table and finished with dark leather seats.

The lavatory walls and ceiling are finished in white and blue metal tile, the floor being covered with a linoleum in a tile effect. The toilet fixtures are all in nickel and the mirror is a beveled oval with a white enamel frame. A linen closet is provided, the front part of which is used for hanging coats and hats.

INTERIOR OF OBSERVATION COMPARTMENT.

The kitchen is finished in a white and blue metal tile the same as the lavatory. The furnishings consist of a special car range designed to burn coal, a stationary sink, a work table with a cupboard and drawers beneath and shelves above, and a full height cupboard and refrigerator. The space over the kitchen hallway is utilized for the storage of kitchen supplies.

The car is mounted on trucks of the M. C. B. type with a 6-ft. wheel base, designed for inside-hung motors. The axles are 5 in. in diameter and the wheels 33 in. The equipment includes two GE-73 motors. Standard M. C. B. draw heads are provided.

The car is fitted with an arc headlight, standard classification lamps and flag brackets. The interior lighting is effected by means of 30 incandescent lamps set in fixtures of ornamental bronze.

The charge made for renting this car is $25.00. For this amount the company furnishes a motorman, conductor, chef and a porter. The party renting the car notifies the company regarding what they wish in the way of refreshments. The company purchases all of the supplies and charges the renting party with the actual cost of them. The car has been rented a number of times and is said to be a very popular means of entertaining.

Fairview Park.

INDIANAPOLIS TRACTION & TERMINAL CO.

Fairview Park, the property of the Indianapolis Traction & Terminal Co., is located about six miles from the center of the city of Indianapolis. It is a beautiful tract of rolling land, containing 350 acres of wood and lawn, through which flows a fine stream of water. The park is operated directly by the company, but some small concessions have been granted to individuals. The popularity of the park has been much increased by concerts given by some of the finest bands in the country, which are engaged for weekly stands.

Ontario Power Co.

Consul Webster, of Niagara Falls, Ontario, writes that the year 1905 has been one of increased prosperity for Niagara Falls, Ontario, owing to the partial completion of the enormous power plants now in course of construction upon the Canadian side of the river. When fully completed these plants will develop 425,000 h. p. Two, those of the Canadian Niagara Power Co., and the Ontario Power Co., are now in operation and are being enlarged as fast as the necessary machinery can be installed. About $10,000,000 has already been spent in developing power, and the total outlay will probably be three times this amount. Under the franchises one-half of the power developed must be sold in Canada if there proves to be a sufficient demand for it. Already a large amount of power is being transmitted to the United States, and preparations are being made to provide new transmission lines of aluminum crossing the river from tower to tower below the whirlpool. It is also expected that the motive power for several great railways will soon be supplied by the Canadian power houses.

Time Schedules for Operation of City Cars in Sheboygan, Wis.

In order that the returns from the operation of the city cars of Sheboygan, Wis., might be more satisfactory and better service offered, Ernest Gonzenbach, general manager of the Sheboygan Light, Power & Railway Co., has made some changes from the usual scheme of city operation by issuing schedules showing the stated time at which all cars pass certain street corners. The results of this scheme for operating cars on a city system have been especially satisfactory and we are pleased to be able to describe this new method for perfecting city service.

The city of Sheboygan has a population of about 25,000 and the trackage of 12 miles is quite large when compared with the size of

FRONT VESTIBULE OF CITY CAR SHOWING TIME CARD, WATCH POCKET AND MIRROR.

the city. As the cars were operated before the recent changes were made it was necessary to keep in service so large a number of equipments in order to maintain a fairly frequent schedule that the city operation could hardly be considered quite profitable. Several months ago the management decided to slightly increase the schedule speed and lengthen the headway between cars thus attempting to offer practically the same service with a smaller amount of rolling stock. This course was pursued, notwithstanding the expectation of considerable public protest and in order to satisfactorily maintain faster schedules, without a change in the motive power equipment, suitable time-tables were arranged and distributed.

These were presented in the form of a "Vest Pocket Guide to the Street Cars of Sheboygan, Wis." The guide includes eight pages, 2½ x 5 in. in size. The first or title page bears the statement, "It is better to run few cars and keep those few on time than run many cars at haphazard." On the second page are "a few rules" which apply especially to the conduct of employes toward passengers. Pages three, four, and five are devoted to the schedules of the three city lines. For each of these lines the colors of the day and night marker signs are given and the complete schedule for one car in each direction over its route. The time table is arranged with the list of permanent street corners and other specified stopping points printed in a column down the center of the page. On either side of this column opposite each stopping point, is shown the number of minutes after the even hour at which a car is due. Pages four and five, showing the schedule arrangement for half-hour and for 20-minute service, are reproduced herewith.

Pages six, seven and eight display the time tables for interurban cars, mail, express and freight service, special workingmen's cars, theater service and the different forms and prices of coupon books, workmen's, clergymen's and school tickets and the prices for special cars.

There were 10,000 of these pocket guides printed and distributed. Large numbers were left in each business house, hotel, saloon or store of any kind in the city and as many as possible were distributed among the patrons of the road. This having been done the number of cars in service was reduced and the headway between cars increased, the exact time when a car is to pass a corner being definitely stated in the time tables, as illustrated on this page.

In the front vestibule of each car, as shown in the illustration, is hung one of these schedules and under the schedule is placed a leather watch pocket in which the motorman keeps his watch. It is stated that the men have become, by the aid of this arrangement, remarkably accurate in keeping their cars to the published schedule. At first the motormen considered it somewhat of a hardship to keep a watch before them and run so very accurately, but now after having become accustomed to this method of operation they realize the value of the schedule and watch. It is no longer necessary for the management to urge motormen to keep their watches in the leather pockets.

During the winter the city cars are operated without conductors and to aid the motorman in watching his passengers while operating his control apparatus, mirrors, as shown in the illustration, have been placed in the vestibules. These mirrors are somewhat larger than those ordinarily used and are mounted at a suitable height on the left-hand side of the center window in contrast with the usual custom of placing the glass above the motorman's head thus necessitating a decided change in position when he desires to see what is going on inside the car. The mirror is mounted on trunions fastened to the platform post so that it can be moved through an arc of about 30°. This arrangement has proved to be very satisfactory and the breakage has been extremely small.

To further lessen the duties of one man operating a car the "Peacock" brakes have been placed on all the city rolling stock. The reason for this course is stated to have been not so much a mechanical one as a desire to lessen the effort required in stopping a car, since by the use of these brakes a motorman can control his equipment with ease and convenience and is not obliged to apply his entire mental and physical strength to the task. When there is no conductor on the car and the motorman is obliged to look forward and to the rear, a brake which will operate safely and with but little exertion is especially to be desired.

The results that have been achieved by the operating schemes here outlined have been entirely satisfactory as is shown by the financial returns and the good feeling existing between the patrons and the street railway company. There are now being operated one-third less cars than under the old scheme, but these cars are held absolutely to the published schedules. The gross receipts have

West Side and Superior Avenue

Red Day Sign. Red Light at Night.
Half Hourly Service.

East bound Read up — West bound Read down

Minutes after the hour			Minutes after the hour	
15	45	Ar. Superior and 8th..Lv	15	45
14	44	Mich & 8th (transfer point)	16	46
13	43	..... Hotel Foeste. ...	17	47
12	42	.Wisconsin and 8th	18	48
10	40	Penn. & 8th (transfer point)	20	50
38	08	.Penn. Ave. Bridge..	21	51
37	07	...C. & N. W. Depot..	22	52
35	05	Penn and 14th .	24	54
33	03	..New Jersey and 15th	26	56
31	01	Indiana and 15th.	28	58
30	00	Lv Indiana and 18th...Ar	29	59

First car leaves Superior Ave. 6.15 a. m.

First car leaves Indiana and 8th 6:30 a. m.

Last car leaves Superior Ave. 10.15 p. m.

Last car leaves Indiana and 18th Street 10.30 p. m.

West Side line is subject to occasional short delays on account of R R crossings, etc.

4

East Side--Belt Line.

Blue Day Sign Blue Light at Night.
20 Minute Service.

	Minutes after the hour		
Penn. & 8th (transfer point)..Lv	05	25	45
Wisconsin and 8th......	07	27	47
Hotel Foeste............	08	28	48
Mich. & 8th (transfer point).	10	30	50
Superior and 8th.........	11	31	51
Zimball and 8th.........	12	32	52
Bluff and 8th	13	33	53
Bluff and 6th..........	15	35	55
Grant and 5th..........	17	37	57
Superior and 5th	18	38	58
Michigan and 4th......	19	39	59
Erie and 4th.........	20	40	00
Wisconsin and 4th......	21	41	01
Penn. and 4th	22	42	02
Penn. and 8th . Ar	24	44	04

First car leaves 8th and Penn. Ave 6:45 a. m.

Last car leaves 8th and Penn Ave. 10.05 p. m.

East Side Car makes one extra trip in *reverse* direction each morning leaving Waiting Room at 6:25 a. m.

5

TWO PAGES FROM CITY CAR SCHEDULE USED AT SHEBOYGAN, WIS.

not been decreased neither have they been increased very materially. They are said to be about 5 to 10 per cent more on the city cars this winter than they were a year ago when the larger number of cars was being operated. Less power is now required because of the absence of reckless running and because the speed at which the cars operate is determined by the schedule. The remarkable thing that has been accomplished, however, is an increase of about 70 per cent in revenue per car mile, which after good service is afforded, is the main object.

Edward W. Moore, the New President of the Lake Shore Electric Railway Co.

Edward W. Moore, the new president of the Lake Shore Electric Railway Co., is a pioneer in the promotion of interurban electric railways. It is estimated that since Mr. Moore made his first street railway investment in 1889, he has been interested in traction lines, both city and suburban, aggregating some 3,000 miles. The operations of the Everett-Moore Syndicate during the past 10 years have practically all been financed by him. He is an indefatigable worker, a man of ability, magnetic personality and is very optimistic. Combined with these qualities is a strong liking for the traction business, especially the financial end of it. It is not strange, therefore, that he has been successful and that his ability is recognized by those with whom he comes in contact.

EDWARD W. MOORE.

Mr. Moore is of German descent and was born in Canal Dover, O., July 1, 1864. After receiving a common schol education, he entered, in 1880, the banking house of Everett, Weddell & Co., of Cleveland, as a junior clerk. Soon after this he secured a clerkship in the treasury department of the Nickel Plate R. R. and for several years was with that company, first during its construction and later during its operation. He next entered the service of the East End Bank and when the Dime Savings & Banking Co. was organized, he was made secretary-treasurer and active manager of that institution. While with this company, he became largely interested in the street railway business and was associated with Henry Everett. The interests of the Everett-Moore Syndicate had become so large and important that Mr. Moore resigned his position with the Dime Bank and gave his whole attention to the affairs of the syndicate.

His first street railroad investment was made in 1889, when he purchased some stock in the East Cleveland Railroad Co. In the same year, he also became interested in a syndicate which purchased the Toronto Street Ry., changed it from horse to electric and assisted in its refinancing. In 1893 he was a member of a syndicate which purchased the Syracuse Rapid Transit Co. He became interested in the Montreal Street Ry. in 1893, being a member of the syndicate which purchased that property and changed its motive power from horse to electricity. About this time Mr. Moore was also interested, in a smaller way, in the Winnipeg Street Ry. and in a railway known as the Montreal Park & Island Street Railway Co. He was a member of the syndicate headed by Green Pack and Henry Everett which built 62 miles of street railway in Detroit in 1894, called the Detroit Ry. This road was operated for several years, when it was consolidated with the Detroit Citizens and with the Detroit, Ft. Wayne & Belle Isle railways, forming the Detroit United Ry. The Everett-Moore interests were in the minority after the consolidation, but later the Wilson interest was purchased which placed the syndicate once more in control of the Detroit United Ry. In the interests of the Detroit United, the Northwestern, the Detroit & Flint, the Pontiac lines, the Detroit & Port Huron Shore Line and the Sandwich, Windsor & Amherstburg companies were purchased, all of which were consolidated with the Detroit United System.

Mr. Moore was interested in a syndicate which, in 1894, purchased the London (Ontario) railways, changing the motive power from horse to electricity. The Everett-Moore people still own this property and have seen its gross earnings increase from $32,000 per annum to $194,000. Mr. Moore was vice-president of this property for several years and is now a director.

In 1894 Messrs. Everett and Moore formed a syndicate and built the Akron, Bedford & Cleveland line. Later the purchase was made of the street railways and illuminating plants of Akron, the Akron & Cuyahoga Falls Rapid Transit Co., a city and suburban line running from Barberton through Akron to Cuyahoga Falls and Kent. These properties were all consolidated with the Akron, Bedford & Cleveland line and the new company was known as the Northern Ohio Traction Co. In 1895, these same men built the Cleveland, Painesville & Eastern Ry., to which afterwards was added the shore line division of this road.

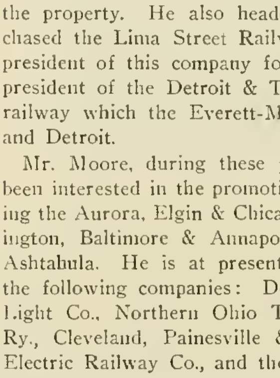
Mr. Moore was the leading spirit in the syndicate which built a trolley line running from Cleveland to Lorain, which was also financed by him. Later purchase was made of the Toledo, Fremont & Norwalk, a road running from Toledo to Norwalk. He was a member of the syndicate which built the Sandusky & Interurban, which syndicate also bought the Sandusky Street Railway Co. Mr. Moore also conducted the negotiations which resulted in the merger of the Lorain & Cleveland, the Toledo, Fremont & Norwalk, the Sandusky & Interurban, and the C. D. Barney & Co. properties, consisting of the Sandusky White Line and the Sandusky, Milan & Norwalk. These properties were united under the head of the Lake Shore Electric Ry.

The traction and lighting companies of Toledo were purchased by the Everett-Moore Syndicate in 1901 and were consolidated under the name of the Toledo Railways & Light Co. Mr. Moore had largely to do with financing this deal and is a large holder in the property. He also headed the syndicate which in 1895 purchased the Lima Street Railway Co. and re-equipped it. He was president of this company for three or four years. He was also president of the Detroit & Toledo Short Line Ry., a double-track railway which the Everett-Moore Syndicate built between Toledo and Detroit.

Mr. Moore, during these periods we have mentioned, has also been interested in the promotion of other traction properties including the Aurora, Elgin & Chicago, Scioto Valley Traction Co., Washington, Baltimore & Annapolis, and the Cleveland, Painesville & Ashtabula. He is at present largely interested and a director in the following companies: Detroit United Ry., Toledo Railways & Light Co., Northern Ohio Traction & Light Co., London Street Ry., Cleveland, Painesville & Eastern Railway Co., Lake Shore Electric Railway Co., and the Eastern Ohio Traction Co.

Recent Changes in the Personnel of the Rhode Island Co.

The personnel of the Rhode Island Co., of Providence, R. I., has recently undergone a change, which change is rendered of more than passing interest by the fact that men, still young in years, have been placed in positions of considerable responsibility. While all credit should be given to the older heads who have, through years of earnest work, built up the large interurban systems of the country, the changes referred to would seem to indicate that the day of the young man in street railway management is at hand.



A. T. POTTER.

In these changes, Albert E. Potter has been made general manager of all the lines running out of Providence, Pawtucket and the Attleboros. Mr. Potter, who is the only son of Albert T. Potter, the former general manager and present vice-president of the company, will not be 33 years of age until June next. His entire experience has been gained on the lines of the Union Railroad Co. and on those of the Rhode Island Co., which succeeded it. He began at the lowest round of the ladder and has worked up to his present position in the comparatively short period of 13 years. He is unusually well adapted by nature and by training for the post he is to fill.

In April, 1892, Mr. Potter, then but 19 years of age, began his railroad experience. He was employed on track work, as the nearest approach to a roadmaster that the Union Railroad Co. had at that time. He held this position for three years and was then made assistant chief conductor, his duties being connected with the operation of the cars and the assignment of conductors and motormen to the various lines. In 1897 he was made superintendent of transportation, a new office created for the purpose of providing a new head with additional powers for the work of

keeping the cars moving. He retained this position when his father retired from an active to an advisory capacity as vice-president three years ago, being succeeded as general manager by Mr. Robert I. Todd, the present incumbent of the office, whom the younger Potter succeeds.

The position made vacant by the promotion of Mr. Potter will be filled by Mr. Samuel Riddle, another young man. Mr. Riddle was but 28 years old on his last birthday. He graduated from Swarthmore College with the degree of Bachelor of Science in Engineering in 1897, and for five years after was associated with Dr.


A. E. POTTER.


SAMUEL RIDDLE.

W. A. Drysdale, consulting mechanical and electrical engineer in Philadelphia. From that time and until his connection with the Rhode Island Co., in March, 1904, he has been engaged in the installation of electric lighting and power plants.

He has a wide knowledge of the theory and practice of the electrical end of the business and has worked through all the other branches of it since locating in Providence. He spent two months in the repair shops, studying car equipments and making himself familiar with every detail of their construction and operation. He then went to the power house where he spent six weeks, after which he spent five months on track work and three months more in studying the conditions in the car house. As there are now 53 lines in the transportation system of the Rhode Island Co., the labor of becoming familiar with these lines and the conditions obtaining upon them is by no means light. By reason of his varied experience Mr. Riddle is well prepared to take up the work of his office.

The Southwestern Electrical & Gas Association.

It is announced by Secretary Frank J. Duffy, that the annual convention of the Southwestern Electrical & Gas Association will be held in Galveston, Tex., on May 16th, 17th and 18th. A large attendance and an interesting program is predicted. The officers of the association are: M. M. Phinney, president; J. W. McLendon, first vice-president; E. W. Dunaway, second vice-president; J. P. Crerar, third vice-president; Frank J. Duffy, secretary, and A. E. Judge, treasurer.

Quarterly Meeting of the New York State Association.

At a recent meeting of the executive committee is was decided to hold a special meeting of the Street Railway Association of the State of New York at Elmira on March 29th, to discuss the following transportation topics: "Interchangeable Mileage Books," "Collection and Registration of Interurban Fares," "City Schedules," "Advertising," "Methods of Discipline," and "Station Rules."

The meeting, as in the case of the Schenectady quarterly meeting, will be in the nature of a conference, and the entire day will be devoted to the reading of papers and discussion on the above topics. All member and non-member companies in New York State, and electric railway companies outside of the state, are earnestly requested by President Danforth to have a responsible representative from their operating departments at the Elmira conference. Delegates and representatives are urged to bring their statistics and data on costs with them.

Car Axles, as Discussed at the March Meeting of the New England Street Railway Club.

At a regular monthly meeting of the New England Street Railway Club, held at the American House, Boston, Mass., on the evening of March 1st, a paper upon "Axles" was presented by Mr. E. T. Millar, general car foreman of the Boston & Main R. R. Previous to the reading of the paper, several new members were elected and the announcement was made that the annual banquet of the club would be held at the Hotel Somerset, Boston, on the evening of March 22nd.

Mr. Millar introduced his subject by pointing out the disadvantage of the Muley or buttonless type of journal, including the end thrust axle. This type includes both the journal which has a piece of metal coming in contact with the end of the axle and the one having a piece of metal which slides down into a groove cut in the end of the axle. The inspector cannot determine the condition of the bearing without removing this piece of metal, and the number of spare parts which it is necessary to carry in stock, is thus increased. The packing must also be applied in an undesirable manner. The wear of the metal on account of end thrust is severe, tending to cause excessive side motion. The metal which takes the end thrust in the M. C. B. type of bearing wears by reason of the thrust, the thickness being reduced at the same time.

Axle specifications and formulas are absolutely necessary, for upon them depends future safety, economy, quality and price. There are no parts of a car which should receive more attention than the axles, for the heating of them delays traffic and their breaking endangers life. For axle purposes open hearth steel is preferable to steel made by the Bessemer converter process, the latter having the reputation of being more liable to break under shock. The M. C. B. specifications call for the following chemical properties for a steel axle: carbon, 0.4 per cent; manganese, not over 0.5 per cent; silicon, 0.05 per cent; sulphur, 0.04 per cent; phosphorus, not over 0.05 per cent. Mr. Millar recommended a tensile strength of not less than 80,000 lbs. per sq. in., with an elastic limit of 40,000 lbs. per sq. in. Proper annealing improves an axle. All axles should be free from cracks, seams and flaws, and all journals should be turned smooth and rolled before being put into service.

In regard to the renewal of axles, the M. C. B. standards set the limit of wear at 5 in. diameter in 100,000-lb. cars and 2¾ in. in 20,000-lb. cars. On the Boston & Maine's electric line at Concord, N. H., the weight of each car without passengers, is 40,000 lbs. The journals, when new, are 3¼ x 6 in. When the journals are worn down to 3 in. they are scrapped, and during the time of service, if the inspector finds that the axle has become worn and that it tapers to the extent of 1-32 in. between the back and the front, the wheels are removed and the axle is trued up, receiving the same treatment as if it were new.

Sharp corners should be avoided in cutting key seats for gears. If a milling tool is used to bring the spline seat up to nothing at each end, better results will follow. In the near future, the question of pressing the gears on the axle and thereby doing away with the spline, will receive more attention. The condition of the track is an important factor in the elimination of broken axles and the hard riding of a car is probably often due to track rather than rolling stock defects.

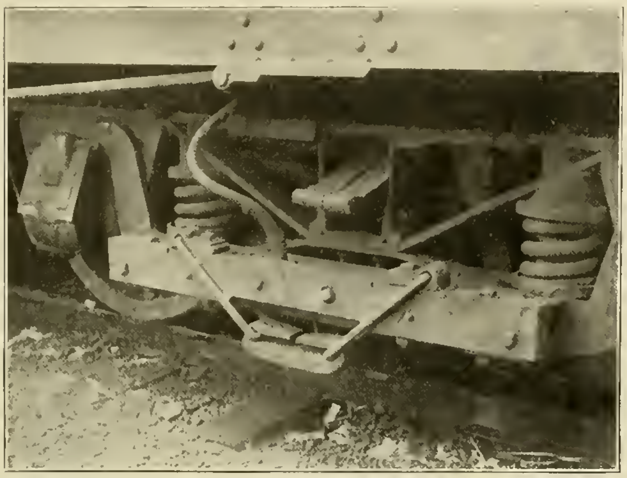
In the discussion which followed the reading of the paper, the point was brought out that the axles of an electric car correspond closely to locomotive driving axles in the strains to which they are subjected. Hammered steel was thought to be desirable for such service. Pressing seems to be the best method of keeping the wheel on the axle. Careful annealing is of more importance than is generally considered. Specifications can be made more severe and still not depart from regular commercial products. Thus, the percentage of phosphorus can be reduced to 0.03 per cent, and the elongation can be increased in a 2-in. test piece from 18 per cent to 22 or 23 per cent at the point of fracture. Only a very small percentage of axle cracks are visible on inspection. Axles can be obtained with a tensile strength as high as 234,000 lbs. per sq. in. if the purchaser is willing to pay the price. In Europe, axles built of chrome-nickel steel are coming into extensive use in both solid and hollow-bored types, and it is probable that they will soon receive the attention of operating companies in this country.

New Designs of Third Rail Shoe and Sleet Cutter.

Two interesting and practical devices for use with third-rail equipments have recently been patented by Don. D. Miles, master mechanic of the Aurora, Elgin & Chicago Railway Co., Wheaton, Ill. The description of these devices will be interesting to those readers engaged in the problems of collecting current from a third-rail or keeping a third rail clear of sleet and ice.

Third Rail Shoe.

The half-tone illustration shows the design of Mr. Miles' new third-rail shoe. It will be noticed that the entire shoe is cast in



THE MILES THIRD-RAIL SHOE IN WORKING POSITION

one piece and is fastened to the bar in a simple and practical way. The suspension of the shoe is made from a wooden bar mounted on angles bolted to the equalizer bar of the truck. These angles project in an L-shape and have the two ends of the insulating bar securely fastened to their faces by means of bolts. This bar being of wood serves to insulate the shoe and the live parts from the truck. On the back of the bar near the center is a suitable connector block to which are fastened the main cable leading to the current control apparatus and the bare flexible copper pig tail which has its lower end bolted to the side of the current collecting shoe, this latter being the only bolt in the shoe. (See cross section on next page.)

As will be seen in the illustration, the shoe is suspended directly below the wooden bar by means of two continuous links which rest in sockets on top of the bar and hook under the ears forming the top part of the shoe. The sockets which hold the upper ends of these links are bolted to the wooden bar by through bolts. Each socket rests upon a plate having cross ridges on its upper surface which mate with similar ridges on the lower side of the socket, and by this means the vertical adjustment of the shoe is effected. If a set of wheels should be changed and it becomes necessary to raise or lower the free position of the shoe the through bolts may be loosened and the ends of the links moved far enough apart to obtain the desired adjustment. Then when the bolts have again been tightened the lower position of the shoe is fixed. The dimensions of the several parts are such that with the shoe thus adjusted it can be raised on a vertical line up to and against the wooden bar without danger of the links coming unfastened.

One of the especially favorable features of this design of third-rail shoe other than its extreme simplicity is the ease with which it can be adjusted or replaced. To remove a broken shoe of this type it is only necessary to loosen the electrical connection and one of the hanger link bolts. This having been done, the links may be slipped through the space in the top of the old shoe and the new one inserted very quickly. The replacing of the link in its former position and the tightening of the holding bolt assures the new shoe the same adjustment as the old shoe.

This design of current collector has been in daily service on one of the high-speed cars of the Aurora, Elgin & Chicago line for about a year and is said to have performed its work in a commendable manner with no trouble from short circuits between the shoe and the truck as has often happened with the standard type of third-rail shoe.

Sleet Cutter.

The line drawings serve to illustrate the detail design of a device for removing sleet and ice from the third rail. This interesting attachment was also designed and perfected by Mr. Miles. As will be seen, this sleet cutter consists of a vertical shaft with a flange at its lower end. On this flange or plate is fastened a second plate of cast steel having projecting from its underside a number of cylindrical shaped bosses which ride upon the upper surface of the third rail. As the car moves along the plate in contact with the rail has a rotating motion about the vertical axis, the bosses thus traveling back and forth across the upper surface of the rail and by virtue of this movement scraping any ice or sleet to one side.

By reference to Fig. 1 it will be noticed that the entire device is supported on the wooden side-bar which carries the third-rail shoe. A set of mating plates is provided for making a proper

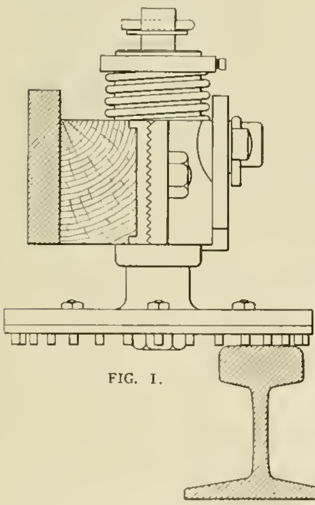


FIG. 1.

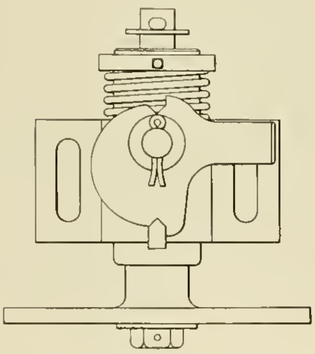


FIG. 2.

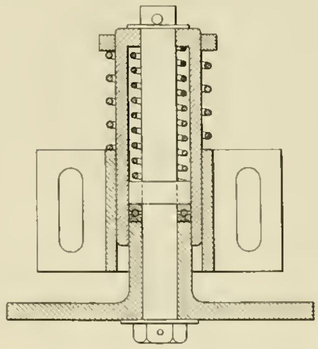


FIG. 3.

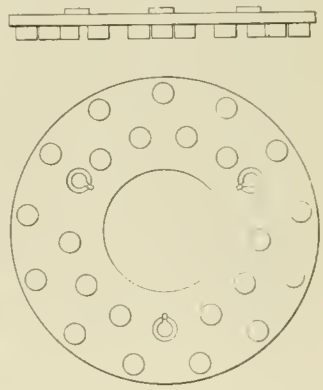


FIG. 4.

SLEET CUTTING DEVICE FOR THIRD RAIL

vertical adjustment. In Fig. 1 the device is shown in action with the cutter held down to the top of the rail by a compression spring enclosed within the barrel which protects the vertical shaft.

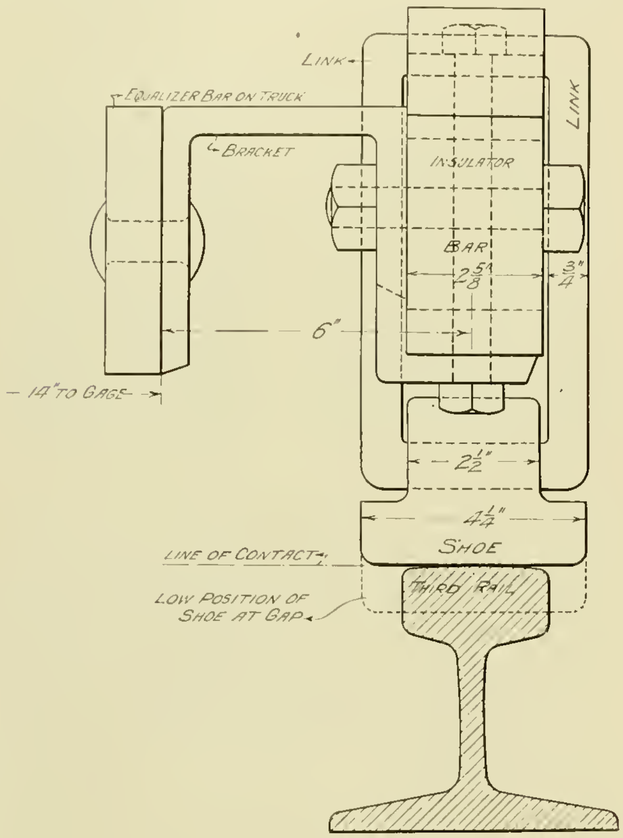
The helical spring about the outside of the barrel acts together with the cam shown in Fig. 2 in lifting the cutting plate away from the upper surface of the rail whenever it is not desired to use the device. This cam is thrown at will by a wooden handle having a metal socket which fits over the short projection seen on the side of the cam. A dog is provided which engages in suitable notches to lock the cam at the working or idle position of the cutter.

Fig. 3 is a cross section of the device showing the vertical shaft, the compression spring and the ball bearing for lessening the friction of the revolving spindle. In this view the cutter is shown in

a released position as it should be when not engaging the top of the rail.

Fig. 4 shows the plan and elevation of the removable cutting plate with its two rows of teeth or bosses.

This self-operating device has been in practical operation on one of the regular cars of the Aurora, Elgin & Chicago Ry. during the



SECTION OF THE MILES THIRD-RAIL SHOE

past winter and although the weather has not been specially severe except at one time, the cutter did at this time perform its work in a satisfactory way and has shown that it will remove the sleet under a severe test with the car operating at schedule speed.

New Equipment for Peru.

Within the present year, Lima, Peru, will have a modern electric railway system. This line, which will include 30 miles of single track, is now under construction for the Ferrocarrilles Urbano de Lima Co., which, for several years, has been operating horse cars in Lima. About one-half of the work of electrical equipment will be completed by the first of July and the balance, it is expected, will be in operation before the beginning of the year 1907.

The work of converting the Lima street railway into an electrical system is under the direct supervision of A. W. McLimont, who is engineer for the Peru company. The railway material and electrical apparatus that are to be used on this road have been purchased from American concerns through the agency of W. R. Grace & Co., of New York City. Nothing but American railway material is to be used in the electrical work.

The Ferrocarrilles Urbano de Lima Co. is now building a substation at Lima which will be equipped with three 300-kw. rotary converters. Power will be furnished by the Electric Transmission Co. whose hydro-electric power plant is located at Chosica, about 30 miles from Lima. The current is to be conducted from the power station to the railway sub-station at Lima over high potential transmission lines. The General Electric Co. will furnish the electrical apparatus for the sub-station and for the car equipments.

The cars are to be of the open type with single trucks. This electric line is the third constructed in Peru using only American electric apparatus and railway materials. Two suburban lines are now operating out of Lima, one of these, eight miles in length, connecting Lima with Callao, which is the seaport town of Lima. The other line connects Lima with Chorrillos, which is the principal summer resort for the people residing in Lima.

Current is furnished the two suburban lines by the same company that will furnish the current for operating the cars on the city line. Though these properties are distinct and are owned by different Peruvian interests, it is expected, on the completion of the electrification of the city line, that they will be operated jointly.

A New Substitute for the Wooden Tie.

As a result of experiments extending over a considerable period, Jacob Laufer, of Lima, O., has succeeded in perfecting a composition which he claims will form a substitute for wood. It is said that it may be made from any kind of refuse capable of being compressed into a solid mass under pressure although it is not necessary to use a great amount of pressure in making this product. The formula has been patented by Mr. Laufer and he has taken up the final papers covering the invention.

The artificial wood, as it is called, has many of the properties of genuine wood, in that nails can be driven into it with as great or even greater ease. When once driven, it is claimed that it is more difficult to extract them from this material than from real wood. The material is non-soluble in water and resists the effects of water in about the same manner as stone or concrete. When buried beneath the ground, it acts practically the same as stone, the interment having no appreciable effect upon the material.

It is thought that this new substitute will prove especially valuable for railroad ties and fence posts. Mr. Laufer estimates that he can produce a good tie at a price not to exceed 25 per cent of that of the natural wooden tie. It is further reported that the Western Ohio Railway Co. recently made a test of this material which, after being subjected to a current of high voltage, proved itself to be a good non-conductor.

Underground Electric Traction for Buenos Aires.

The Committee of Public Works of the National Chamber of Deputies of the republic of Argentine, S. A., has under consideration the project presented by the national executive and containing several articles which are as follows:

Article 1. Authority is hereby granted to the municipality of Buenos Aires to concede the construction and exploitation of a network of subterranean railways by electric traction for the service of urban traffic and also the right to grant concession of all new branches which, in the future it may be convenient to construct.

Article 2. The concession shall be granted under the following basis: (a) The company obligates itself to construct the lines at its own expense and in strict accordance with plans and estimates which shall be approved by the executive and under the conditions stipulated in the contracts. (b) The expropriation of lands for stations, workshops, power houses, and track shall be made by the company at its own expense and in accordance with said plans. (c) The construction company shall undertake the administration and exploitation of the lines for its own account and risk for a term that shall not exceed 40 years, at the expiration of which time, the lines with their track, stations, workshops, rolling stock and other materials of exploitation shall become the property of the municipality of Buenos Aires. (d) The materials intended for construction and exploitation of the lines shall be imported duty free and the exploitation shall be free from taxation. (e) The contracts for the construction and exploitation that the municipality may effect with the company shall be submitted for approbation to the national executive.

Article 3. The lands necessary for the stations, tracks, workshops and power houses are declared to be for public benefit and their expropriation is hereby authorized.

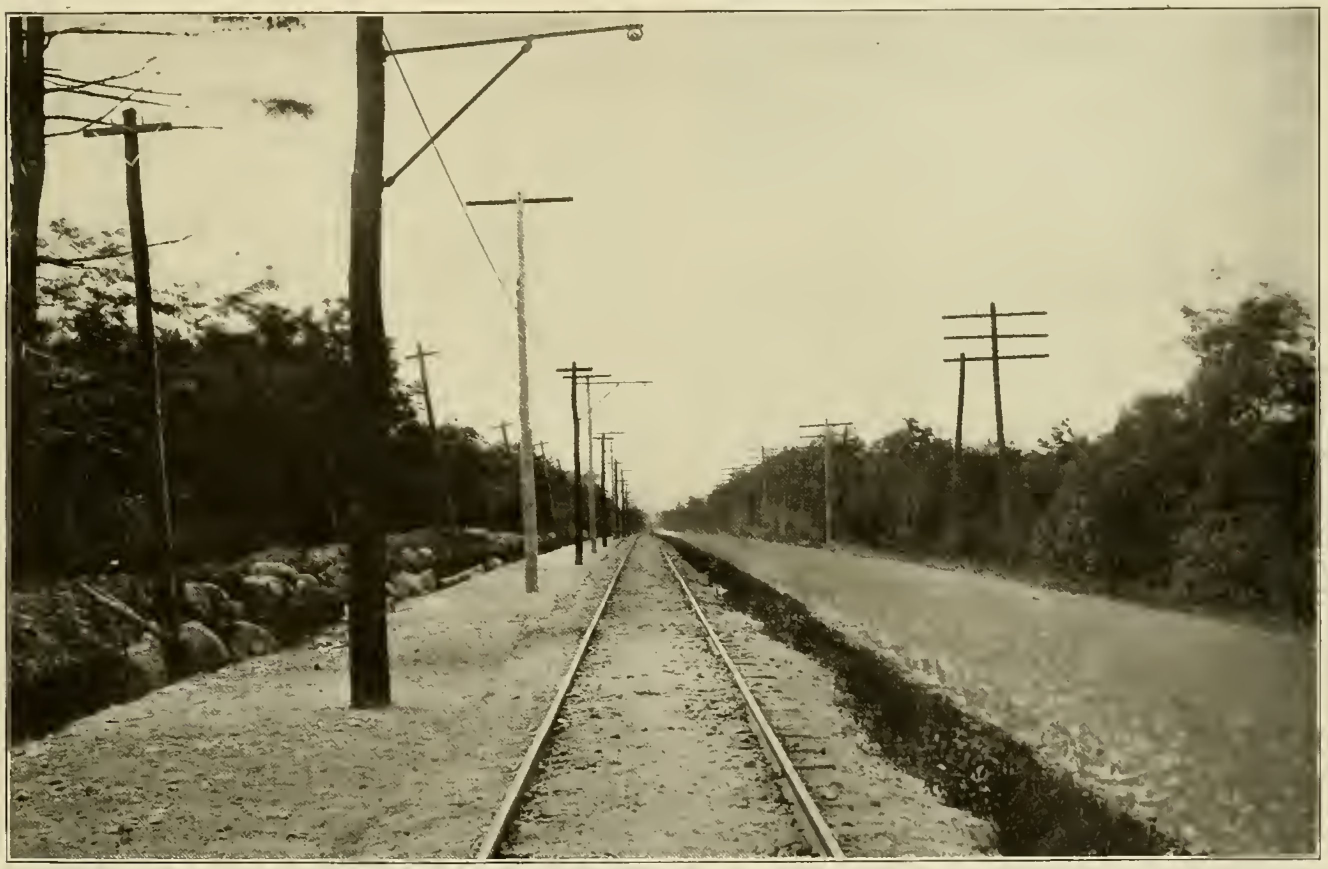
Extensive improvements are planned for the Lake Shore Electric Ry.

The Dartmouth & Westport Street Railway.

An interesting illustration of an electric railway's progress will be found in the following description of the Dartmouth & Westport Street Ry. which operates between Fall River and New Bedford, Mass. This road was organized in 1893 and began operating cars the following year under conditions that were far from favorable as regards earnings. Although handicapped by being forced to buy its power from other companies and compelled to enter the two terminal cities over other companies' properties, this company has built up a passenger and express traffic which, as shown by the accompanying general statement for the year ending Sept. 30, 1905, has enabled it to pay a dividend of eight per cent to the stockholders and retain a surplus for the year amounting to $25,704. The company has a capital stock of $150,000, a bonded indebtedness of $90,000 and a floating debt of $126,103.

without interruption. This has been more or less difficult as the line is located on a state highway and in many places it was found necessary to tear up the old track and move it from one side of the highway to the other in order to eliminate grade crossings. The double track when completed will occupy, for a distance of 10 miles, the northern half of the state road through the towns of Dartmouth and Westport. In the small towns along the line it is necessary to cross the public streets. There is one grade crossing with a steam railroad.

When the line was first opened in 1893, single-truck, 20-ft. cars were operated. After five years these were found inadequate and 25-ft. cars with smoking compartments were substituted. Three years ago standard 30-ft. cars equipped with GE-70 or Westinghouse-101 motors, four to each car, replaced the smaller equip-



VIEW OF THE OLD TRACK ALONG STATE HIGHWAY, SHOWING GRADE COMPLETED FOR SECOND TRACK.

As shown on the following page, the operating expenses are exceedingly high, due in part to the condition referred to in a preceding paragraph. This company was organized when electric railway operation was in its infancy and has since gradually taken on new life until it is now one of the substantial interurban properties of New England.

Reconstruction and Operation.

Early in 1905 the management found that, on account of the demand for more cars and a faster headway, the single track over which it had been operating was inadequate. At that time it was decided to rebuild the old line and lay another track. The work was begun late in the spring and has been vigorously carried on until it is now announced that by the last of April the reconstruction work will have been completed.

During the work of double-tracking, the usual headway of 15 minutes in summer and 30 minutes in winter has been maintained

ment and are still in use. What has obtained in the evolution of the car equipment has also obtained in that of the office quarters and freight traffic and it was found necessary to arrange to furnish a still better service before the opening of heavy freight and passenger traffic this year.

The work of rebuilding was begun near the New Bedford terminal where it was necessary to lift more than a mile of the track from the north to the south side of the highway along which it passes. The new roadbed was finished over this stretch and one track laid. When, everything was completed except the connecting link, men began work after the cars had stopped running at night and the old track was cut in on the new at either end. The following day the old line was lifted bodily to the new roadbed and the cars were operated over it. This method of interchanging from the old to the new roadbed has been followed throughout. As a result of this the second track was built in stretches of a mile or more in length over the level portions and as fast as it was

completed cross-over switches were laid and the cars operated over the double track. When the connecting links between these stretches of uncompleted track were finished the cross-overs were removed and the cars were allowed to continue on to the next stretch of uncompleted track. By this means the company utilized every foot of double track as soon as it was completed and has been able to maintain a faster schedule. When it was necessary to pass from the double to the single tracks, a block signal system was temporarily installed to prevent the possibility of trouble by cars meeting on the single track. The work of reconstructing the

FRONT OF CASINO, LINCOLN PARK.

line was done entirely by day labor and under the direct supervision of the company.

The reconstruction of the track consisted in building a new bed, substituting 75-lb., 30-ft. steel for the 65-lb. rails then in use, installing Weber joints in place of the six-hole splice bars, replacing the 30-in. exposed bonds by 9-in. American Steel & Wire Co's. pin bonds with 7/8-in. terminals and replacing the old ties with 6 x 8-in. x 8-ft. cypress and oak ties. The double track is laid with 10-ft. centers. The rails are cross bonded frequently and at intervals taps are made into the aerial return cable which is composed of three wires, 300,000 c. m. in total section.

Power is to be furnished by the Union Street Railway Co. of New Bedford and the Old Colony Street Railway Co. of Fall River as has heretofore been the case. No sub-stations are necessary on the line to maintain the proper voltage. Four feed wires are strung in multiple from Fall River and six from New Bedford.

Lincoln Park, which is located half-way between the two cities, is the division point and line-breakers are here installed to prevent tying together the two separately operated power plants

Because of the peculiar location of the line along one side of a highway it was necessary when double-tracking to change the overhead construction from bracket to span. The successful execution of this work was one of the interesting features of the reconstruction, because owing to the frequent passage of the cars at no time could the trolley and feed wires be taken entirely down and wherever it was practicable the poles used in the bracket construction were, and are still, utilized for span wire supports. This was possible only at the western end of the line. Elsewhere it was necessary to set new poles and string new wire before the old work could be torn down. No. 00 wire and 35-ft. chestnut poles were used in the new work.

In reconstructing the roadbed all curves, with the exception of those where passage from the state highway to city and town streets is necessary, will have been eliminated before the through double-track service is opened. The distance from the eastern corporate limits of New Bedford to the western border of Fall River is 10 miles. The track within these cities, over which the Dartmouth & Westport cars run in completing their schedule, is four miles in length. The territory through which the line passes in the suburbs of Dartmouth and Westport is unusually low and necessitated the building up of the roadbed to a height of from two to four feet the greater part of the distance. The line crosses

GENERAL STATEMENT FOR THE YEAR ENDING SEPT. 30, 1905. DARTMOUTH & WESTPORT STREET RAILWAY.

Gross earnings from operation	$154,499.46
Operating expenses	101,825.42
Gross income above operating expenses	$52,674.04
Interest on funded debt, taxes	14,969.78
Net divisible income	$37,704.26
Dividends declared at 8 per cent	12,000.00
Surplus for year	$25,704.26
Amount of surplus Sept. 30, 1905	49,979.64
Total surplus	$75,683.90
The earnings were as follows:	
Receipts from passengers	$137,706.41
Receipts from carriage of freight	15,152.55
Receipts from advertising and mail	1,640.50
Total earnings	$154,499.46
The operating expenses were as follows:	
Salaries of general officers and clerks	$4,187.37
Insurance	1,427.34
Other general expenses	1,087.41
Maintenance of roadway and buildings	2,250.49
Maintenance of equipment	8,750.25
Wages for conducting transportation	21,227.13
Removal of snow	625.38
Damages for injury to persons and property	4,902.59
Payments for power, trackage, storage, etc	43,637.36
Rental of buildings	661.64
Miscellaneous	13,068.46
Total	$101,825.42

marshy ground three miles west of Fall River where there is no solid foundation to build upon. It was necessary to corduroy two miles of this distance and to fill in on top of the foundation thus laid.

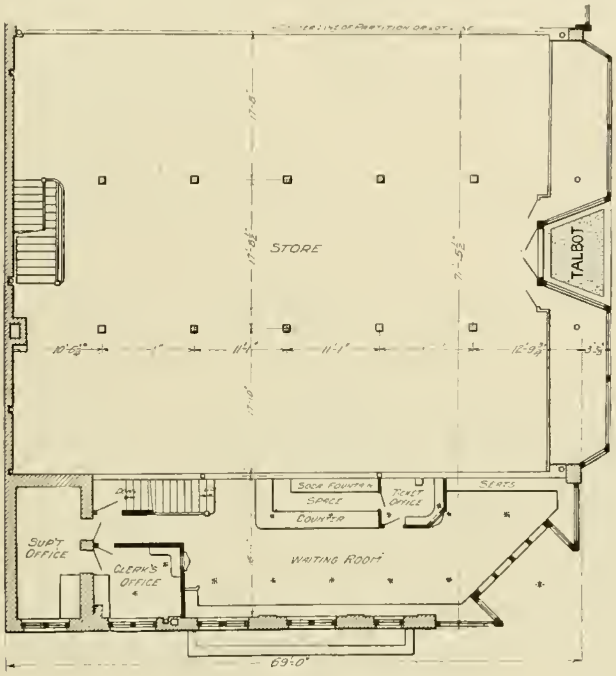
This corduroy was built of ties laid close together on the marshy substance and filled in with rock. On top of this foundation a sub-surface was made of earth, removed from a cut a short

BUILDING CULVERT FOR NEW ROADBED.

distance from the western border of the marsh and still another dressing of crushed rock is to be applied. In order to maintain the schedule of operation it was necessary to do the filling-in work with teams.

The new office building, which was erected by the company in conjunction with the Union Street Railway Co. and the New Bedford & Onset Street Railway Co., is located at the southeast

corner of Purchase and William Sts., New Bedford, which is about the center of the city. It was completed and occupied Jan. 27, 1906. The building is one of the most pleasing structures in the city. It is constructed of brick, is two stories high and has a floor space of 68 x 71 ft. Until the business of the company demands it, a part of the ground floor of the building will be rented for store purposes. The upper floor is occupied by the business



FIRST FLOOR OF OFFICE BUILDING.

offices of the company. The lower floors of the building are of cement foundation and terazza finish, while the upper floors are of hard pine foundation with ash finish. The walls of the waiting room and offices have a wainscoting of quarter-sawed oak. A part of the waiting room is set aside for a book stand and refreshment counter.

Express Traffic.

The Dartmouth & Westport Street Ry. is one of the pioneers in New England in the matter of parcel express. Three years ago the company inaugurated an express system to compete with the other common carriers in this territory. Together with the other street railway interests of New Bedford the company formed a separate department, known as the "Electric Express." From the beginning it has paid a revenue and now has reached a point where it is a substantial source of income of the associated companies, as will be noted by referring to the annual report of operation earlier presented.

At first small, single-truck passenger cars were provided for handling the express matter. As the business increased it be-

AGENT'S NO. ______ **ELECTRIC EXPRESS** C. O. NO. ______

OF THE

PROVIDENCE & FALL RIVER and DARTMOUTH & WESTPORT ST. RY. CO'S

______ 190__

MR ______ AT ______ STATION.

I HAVE MADE THE FOLLOWING CORRECTIONS ON WAY-BILL NO. ______

FROM ______ TO ______ DATE ______ 190__

WAY-BILL READS PREVIOUS TO CORRECTION

Consignee and Destination	Articles	Weight	Rate	Freight Charges	Expenses	Amount to Collect	Prepaid
	Original Footing of Way Bill						

WAY-BILL READS AFTER CORRECTION

Consignee and Destination	Articles	Weight	Rate	Freight Charges	Expenses	Amount to Collect	Prepaid
	Corrected Footing of Way Bill						

I HAVE FOUND THE ABOVE CHANGES CORRECT ______ AGENT.

______ AGENT.

RECORD OF AGENT'S CORRECTIONS IN WAY-BILL. (ORIGINAL 8½ X 11 IN.)

came necessary to build regular freight cars, of which the company now has two in operation, each making from one to three daily trips over the lines.

Under the system now in vogue freight from any point on the Dartmouth & Westport Street Ry. can be delivered to stations on the Union Street Ry., the New Bedford & Onset Street Ry. and the Providence & Fall River Street Ry. Goods are transferred at the main station at New Bedford and sent out over the various lines. A careful record is kept of each shipment both at the shipping and receiving stations and at the end of the month the agent's reports are forwarded to the general manager who in turn reports the month's business to the officers of the several companies. Upon receiving the general manager's statement a

M ______ **FALL RIVER STATION.**

Address ______ 190

Pro. No. ______ Car No. ______

Electric Express of the Dartmouth & Westport and Providence & Fall River St. Ry. Co's.

Received in good order, unless otherwise noted, the following goods:

Transported from ______ W. B. No. ______ Date ______

SHIPPER	NO.	ARTICLES	WEIGHT

Delivered ______ 190 (Sign Here.)

DELIVERY CHECK By ______ For Consignee.

Cashier's Check.

Consignee.

Month ______ 190

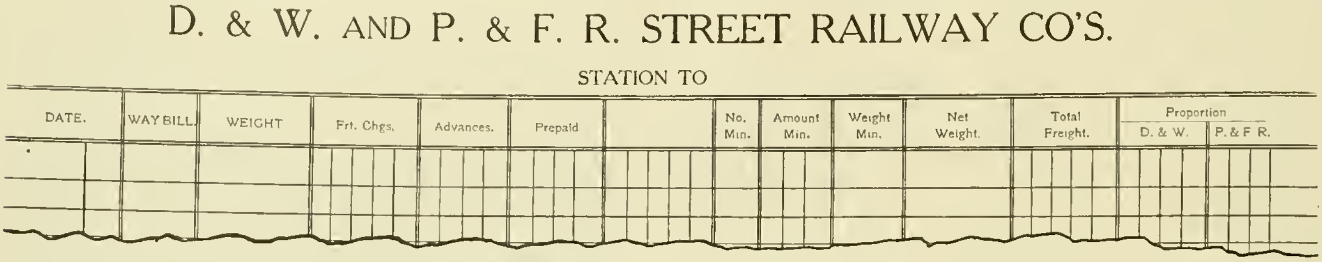
Pro. No.

RATE	CHARGES
Advances	
Total	
Cartage	

COMPANY'S RECEIPT FROM CONSIGNEE. (ORIGINAL 8½ X 3½ IN.)

balance is struck by the auditors and checks drawn to cover the differences in amounts due the other companies from excess of freight sent from some other line above the amount sent from stations on their own line.

The forms used by the "Electric Express" are in some respects similar to those used on steam roads. Special forms of way-bills, both in full and half sheets, whereby three copies can be had by the use of a double-faced carbon sheet, have been worked out by the manager of the express department. Two of these bills go on the car with the shipment of goods and the third, which is on tissue remains in the office from which the shipment is made. The half sheet form is used when the consignment is small. The shipping receipts used vary according to the shipment to be made. Special forms by the use of which the receipts can be made out in triplicate have been found advantageous. These are used for shipments of machinery, etc.


D. & W. AND P. & F. R. STREET RAILWAY CO'S.

STATION TO

DATE.	WAY BILL.	WEIGHT	Frt. Chgs.	Advances.	Prepaid		No. Min.	Amount Min.	Weight Min.	Net Weight.	Total Freight.	Proportion D. & W.	Proportion P. & F. R.

SPECIAL FORM USED IN ACCOUNTING FOR EXPRESS MATTER HANDLED BY TWO COMPANIES. (ORIGINAL 10¾ X 13½ IN.)

The express department does not attempt to compete with the rates of steam roads but depends entirely upon the quality of its service to get the business. When goods are received they are at once reshipped and the way-bills sent on later, thus hastening the delivery. In facilitating delivery mistakes of minor importance sometimes occur, and in order to rectify these a correction blank, as is shown in an accompanying illustration, is used. This form shows the way-bill as it read previous to correction and as it reads after the correction has been made by the agent at the receiving station. The rates charged for carrying express are based on the standard railway classification as follows:

Rates in cents per hundred pounds.

Miles.	New Bedford to	Class 1	2	3	4	5
3	Smith Mills	8	7	6	6	6
7	Lincoln Park & West. Fact	8	7	7	6	6
10	Beulah	9	8	8	7	6
13	No. Westport	10	9	8	7	6
15	Fall River	10	9	8	7	6
21	Swansea Center	14	12	11	10	9
25	Barneyville	16	14	12	11	10
29	Seekonk	18	16	14	12	11
34	Providence	20	17	15	13	12
2	Fairhaven	5	5	5	5	5
7	Mattapoisett	7	7	6	5	5
12	Marion	8	8	7	6	5
18	Wareham	11	10	9	8	7
20	E. Wareham	13	12	10	9	8
21	Onset	14	13	11	10	9

Baggage, trunks, etc.	.15
Minimum charge 25 lb. and under	.15
Over 25 lb.	.25

Three round trips daily are made by the express cars between Fall River and New Bedford, two between New Bedford and Providence and two between New Bedford and Onset. The company recently placed a solicitor in the field, whose duty it is to call on manufacturers and merchants in the territory served by the express system and try to influence them to give a share of their patronage to the electric companies.

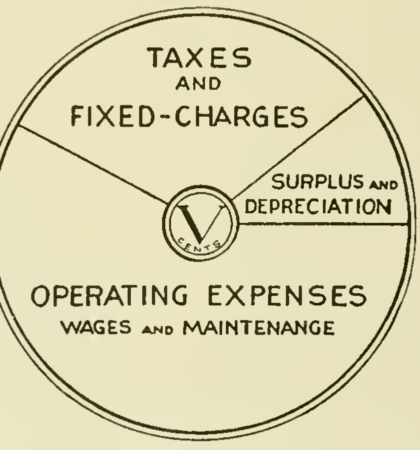
With the opening of the complete double-track line it is expected that a regular mail car service will be installed on the Dartmouth & Westport road, arrangements having already been completed with the United States postal authorities for the installation of such a service. Heretofore the mail has been carried in six round trips daily between Fall River and New Bedford in the vestibule of the passenger cars.

Lincoln Park, located at a point half-way between Fall River and New Bedford, is the principal summer amusement resort of the people of these two cities. The park is laid out in a forest reserve. During the summer months high grade vaudeville is presented here under the direct supervision of the railway company. Besides the theater a large carrousel and a dancing pavilion are maintained by the company. The park has become, through the railway's management, a favorite family resort.

The officers of the Dartmouth & Westport Street Railway Co. are: President, H. H. Crapo; secretary, R. S. Goff; treasurer, S. S. Wilde; superintendent, E. E. Potter.

Where the Nickel Goes.

The question as to what proportion of the receipts of a street railroad company goes toward maintenance and improvement to the equipment and what proportion eventually finds it way into the pockets of the stockholders, is one that causes considerable interest to the public mind. It is the popular, though generally erroneous belief, that the last mentioned amount is greatly in excess of the former. It will therefore be of interest to note some actual conditions as given the public by the United Railroads of San Francisco, Cal., in a recent issue of its publication known as "Transit Tidings."



WHERE THE NICKEI GOES.

The accompanying diagram presents the situation in a plain and unmistakable manner. The proportion of the nickel fare going to the several fixed and varying charges is indicated in amount by the size of the different divisions of the circle. It will be noticed that the division set apart for depreciation and surplus, forms but a small fraction of the nickel, less than one-eighth in fact.

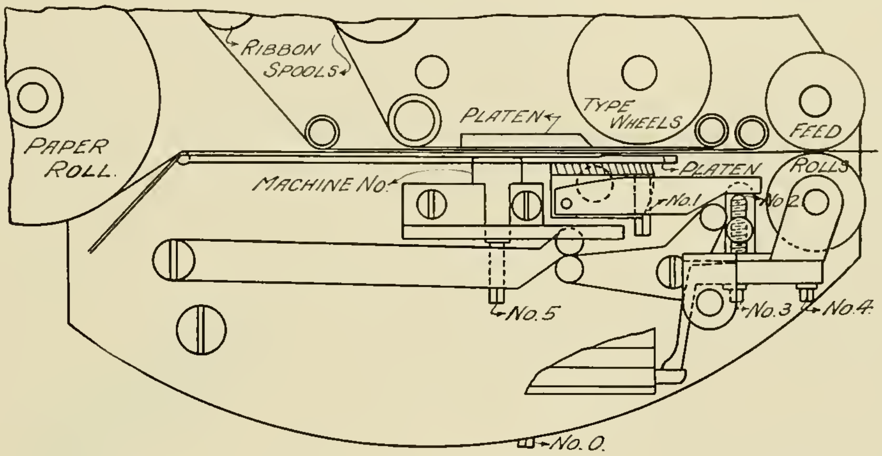
The proportion going towards taxes and fixed charges, is more than one-half. In the matter of taxes, the expense of the company is said to be over $1,000 per day. It is further claimed that this corporation pays one-twentieth of all the property tax paid into the city and county. It is evident that the company is not a tax shirker. Operating expenses, wages and maintenance eat up more than half of the receipts. The company has a number of improvements in view, all of which will make for the good of San Francisco and the traveling public.

New Security Recording Register.

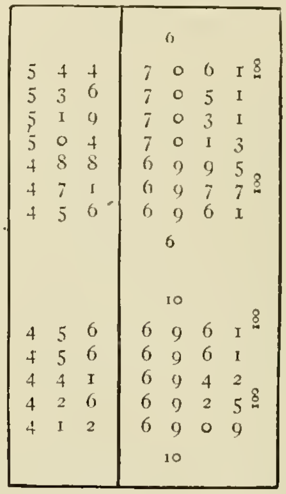
During the last few years the Security Register Co., St. Louis, Mo., has been perfecting a recording fare register. The new product has shown such satisfactory results in actual operation on a number of different railway lines that its manufacturer now announces it to be ready for the market. The general design and size of the case of the new register approximate very closely those of the company's well known non-recording registers. The new instrument is made in both single and double types. In operation a record of the totals may be made at any desired time, such as when the conductor takes or leaves the car and at the ends of the routes. The record has an appearance similar to that of the small portion illustrated herewith. This record is made on a long strip of paper, which in the single registers is 1½ in. wide and in the double registers 2½ in. wide. Other than presenting the totals the record presents identification numbers enclosing the totals of the fares collected by each conductor. It also allows

During the operation of the car over its routes the conductor keeps his day card as usual and operates this new register exactly like one of the non-recording type. Whenever he turns his direction plate the totals are automatically printed on the hidden record strip. If a conductor leaves his car he first removes the operating handle; this as earlier stated automatically prints the totals. He then inserts his identification stamp which presents his number on the record and marks the end of the time that he was in charge of the car. The new conductor is then given the operating handle and manipulates the register in precisely the same manner as the first conductor.

By reference to the reproduction of a small portion of the recording strip, it will be seen that the totals recorded in the manner described appear in two columns, this being a record from a double-type register. On the lower portion of the record appear the totals for both cash and tickets set off at the top and bottom by a conductor's identification stamp, No. 10. It will be seen that this conductor took the car when the totals for tickets and cash were



VERTICAL SECTION OF MECHANISM OF THE SECURITY RECORDING REGISTER.



PORTION OF RECORD STRIP FROM REGISTER.

an inspector who may board a car to check the register and record his visit on the paper in the register. There is also printed at the side of the strip an identification number, corresponding to the number of the recording instrument. This latter feature is to asist the auditing department and to show in a clear manner in what car and instrument each record was made.

On many roads it is the usual practice for the starter to try each register a number of times to see that it is in good working order before sending a car out on the line. With the new recording registers this inspection is easily done. The starter first inserts his identification stamp in one of the several holes in the lower side of the case. This act prints his number on the recording strip. When the starter's number has been recorded and his stamp withdrawn, an operating handle is inserted in the same hole. On turning this handle the reading of the totalizer for both cash and tickets and the identification number of the register are recorded on the paper strip. By an ingenious arrangement the register cannot be used unless the operating handle is inserted and this handle cannot be removed without recording the totals on the tape.

After testing the register the starter again inserts his identification stamp which shows that the difference in totals recorded between his two stamp marks were made by him and are not to be charged against a conductor when the record is received in the auditing department. There is also the desirable feature that an inspector when so instructed, can place his identification mark on the register showing that he has inspected a car on the road, and on what trips the inspection was made.

The starter having assured himself that the register is in good working order, gives the operating handle to the conductor who first records his identification number and then inserts the operating handle. The register is now ready for operation on the line. The insertion of the operating handle printing the totals, spaces the records so that the identification numbers are not printed over the totals but stand out plainly as shown in the illustration.

412 and 6,909, respectively, and that on four half trips the totals for tickets and cash were increased to 456 and 6,961, respectively, thus indicating that 44 tickets and 52 cash fares were received. Conductor No. 10 then left the car and when doing so removed the operating handle and inserted his identification stamp. The removing of this handle automatically recorded the totals at the time he left the car. The car was then given to conductor No. 6, whose record appears in a similar way, set off at the beginning and end by his identification number. Along the side of the strip appears the number of the register as it has been automatically recorded from time to time.

An illustration is presented showing a section of the mechanism of the recording device. It will be noted that the supply of paper is drawn from a large roll on the left, passes over the platen and under the type wheels, through the feed rolls at the right and is there stored on a reel. Each reel will carry enough paper to record 3,000 impressions. This means that the register does not need to be refilled within 30 to 60 days, depending upon the number of trips made per day. The last few feet on each supply roll of paper have a distinctly different color from the other part of the roll, so that when this color is seen by the inspector he knows that a new supply of paper is needed. The recording ribbon will last about two years and all gears and wearing parts are made of high grade cut steel so that their life will be very long.

With this improved recording register the inspector at the carhouse, after the day's run of the car has been completed, stamps the day, hour and car number on the recording strip which is then ready for the use of the auditing department. It is easily seen that with such a record at its command, this department has available close checks on the number of fares collected by each conductor and upon what trips they were paid in.

The New York, New Haven & Hartford R. R. will substitute the overhead trolley system for the third-rail electric service on its Highland division, between Hartford, New Britain and Bristol.

The Hercules Malleable Guy Anchor.

Among the different types of guy anchors that have been placed upon the market, the Hercules malleable iron anchor, which is manufactured by the W. G. Nagel Electric Co., Toledo, O., presents a number of excellent qualities.

The illustration shows the anchor with the rod in two positions. The anchor is made of the best grade of malleable iron, the rod having a welded head and working in a socket which allows the anchor plate to adjust itself to the proper position. The anchor shoe pulls against the solid earth, the hole being dug straight

THE HERCULES GUY ANCHOR IN TWO POSITIONS.

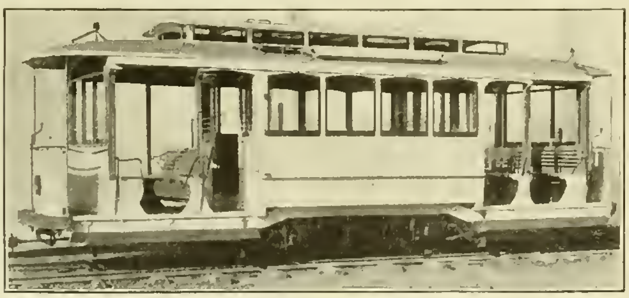
down and a small channel being cut by a special channeling tool just large enough to contain the rod at the proper angle toward the pole to be guyed. It is possible to see that the anchor is in proper position before the hole is filled in.

Past experience in guying seems to indicate that heavy rains occurring after the anchor has been placed will allow it to creep. In other words the tamped earth is washed back of the anchor, allowing the anchor to move forward and thus loosen the guy. It is appreciated by all construction men that a guy once started is very hard to pull back into proper position. One of the strongest points claimed for this anchor is that it will not creep.

These anchors are made in five sizes from No. 1 with a ½ x 6-in. rod and a 5 x 10-in. plate to No. 5 with a 1¼ x 9-in. rod and a 12 x 30-in. plate.

Cars for The Victorian Railway Co. of Melbourne, Australia.

The car shown in the illustration is one of a number which were recently shipped, unpainted, by the J. G. Brill Co. to Melbourne, Australia, for the Victorian Railway Co. The cars are of the "California" type. This type of car is also in considerable use in Australia and New Zealand, and quite a number are to be found in Great Britain. This is the second of two orders of cars of similar design that have been furnished the Victorian Railway Co. within the last two or three years, all of which, including the present order, were mounted on the builders' No. 21-E type of single



BRILL CAR FOR MELBOURNE, AUSTRALIA.

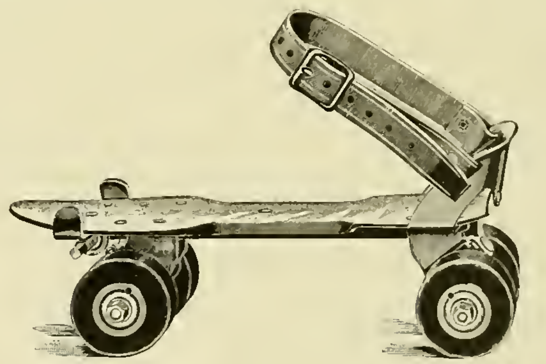
truck. The equable climate of southeastern Australia is well suited to combination cars, and the type has certain features which adapt it to the city service for which it is intended.

It will be noticed that the platform supports are in a single piece from end to end of the car. They are composed of angle irons which are offset for the purpose and which relieve the closed compartment of the strain of the long platforms. This feature is of considerable importance, as the irons not only support the platforms, but also provide for carrying the running boards low. The height of the running board from the head of the rail is 13 in. and from the running board to the platform it is 12 in. The curtains in the open parts of the car may be drawn entirely down to the floor, and the round-corner seat-end panels give them ample working room. Together with the bulkheads the curtains afford protection to passengers on the platforms during stormy weather. The sashes in the bulkheads are arranged to drop into pockets as are also the sashes in the closed compartment. The seats in the closed compartment are placed transversely and have push-over backs. They are upholstered in spring cane. The total seating capacity of the car is 36 passengers.

The cars measure 11 ft. 6 in. over the closed compartment and 28 ft. 4 in. over the dashers; the width over sills of the closed compartment is 7 ft. 9½ in. and that of the open compartment 6 ft. 11¾ in.; the width over posts at the belt of the closed compartment is 8 ft. 4 in. and of the open compartment, 7 ft. 10 in.; the height from floor to ceiling in the closed compartment is 7 ft. 7⅛ in.; the height from the under side of the side sills over the trolley board is 8 ft. 3½ in. and the height from the track over the trolley board is 10 ft. 9⅞ in. The interiors are finished in cherry stained to a mahogany color and highly polished. The ceilings are of bird's eye maple with neat decorations. The truck wheel base is 6 ft. 6 in.; the wheel diameter, 33 in. and the axle diameter, 4 in. The weight of a car and trucks without motors is 13,500 lbs.

Roller-Skating Rinks as Attractions for Amusement Parks.

The pastime of roller skating first became popular in the year 1880, and since then has been in and out of the public favor many times. The most recent revival of interest occurred in the year just past, and will no doubt extend into the coming season. Many amusement parks throughout the country are now adding rinks to



THE UNION HARDWARE CO'S. SKATE.

their equipment for use during the summer months. The revenue accruing from these rinks is not, however, confined to the summer season, as roller skating is popular in winter as well.

The success of a rink depends, to a great degree, upon the quality of the skate which the management offers for rental. Many rinks are equipped with skates manufactured by the Union Hardware Co., Farrington, Conn., and wherever used, they have afforded excellent satisfaction. This company manufactures skates of all kinds for both men and women. Its experience extends over a considerable period and has enabled it to place on the market a durable and efficient product.

Among the railway companies operating parks equipped with these skates are included the Consolidated Railway, Light & Power Co., Wilmington, N. C.; the New Hampshire Electric Rys., Haverhill, Mass.; the Lexington & Boston Street Railway Co., Lexington, Mass., and the Nahant & Lynn Street Railway Co., Lynn, Mass.

The Montreal Street Railway Co., Montreal, Can., will apply at the next session of the legislature for power to increase its capital stock from $7,000,000 to $15,000,000 to provide funds for further construction. The company will not be re-organized.

As there is a demand for a buffet luncheon service on the through cars of the Indiana Traction Co., between Indianapolis and Marion, and other long runs that include hours for meals, the company will give this new service a test.

Proposed Extension of the Toronto & York Radial Railway.

The Toronto & York Radial Railway Co., which includes all the lines running in and out of Toronto, Canada, contemplates a large expenditure for equipment and extensions in the near future. The branch from Toronto to Jackson's Point, a summer resort on Lake Simcoe, is to be equipped with a heavy type of car. The management has not decided how many of these cars are to be built, but as soon as it is determined what system of electrical distribution is to be used, the supplies necessary for the construction of these cars will be purchased. The road from Toronto to Jackson's Point will be about 25 miles long and its construction is being rapidly pushed to completion. In view of the fact that power from Niagara Falls is to be available within the next few weeks the management is considering the adoption of the single-phase system.

The negotiations between the city of Toronto and the street railway company have proceeded sufficiently far so that the company has practically secured concessions for the construction of loops that will permit better service. These loops, proposed by Manager R. J. Fleming, will cut off much dead mileage and relieve the congestion of traffic at the intersections of the principal thoroughfares. When these loops are constructed some 70 new cars will be built. For the new loops and extension about 400 tons of rail will be purchased. A "T" rail with a special paving block will be used on the extension of lines in the outer districts.

A New Stombaugh Guy Anchor.

The illustration shows the type-B Stombaugh guy anchor, patents for which have recently been applied for by W. N. Matthews & Bro., 225 N. 2nd St., St. Louis, Mo. As will be seen by those familiar with the old style Stombaugh guy anchor, the type-B embodies several improvements over the old style, 5 and 6-in. anchors.

THE STOMBAUGH GUY ANCHOR.

Both the 5 and 6-in. anchors are now made with a square shank of equal size permitting the use of the same wrench for both anchors, whereas formerly, separate wrenches were necessary. In the past considerable trouble has been caused the users of 5 and 6-in. anchors by defective welds in the rods and eyes. This undesirable feature has been entirely eliminated in the type-B anchor. A full rod is now used with no welds. The eye is drop-forged and threaded to the rod. A much larger eye is thus permissible and the eyes are now made amply large to accommodate standard guy thimbles but are smooth and of such shape as to do away with the absolute need of the thimble.

The type-B Stombaugh wrench is simple, convenient and strong. The hollow shaft is made of seamless square tubing of much greater torsional strength than the old type of round tube. It is further reinforced by a square key of malleable iron which fits the square shank of the anchor. This key is brazed on. The handles are attached to a sliding cross that is held at any point on the shaft by means of a non-movable set screw. This sliding cross is a great convenience when screwing the anchor into the ground, as the maximum amount of leverage can be had at each stage of the installation.

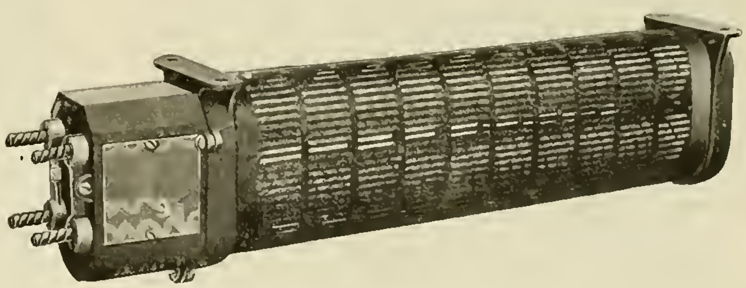
To install the type-B anchor the hollow shaft is slipped over the rod after removing the eye. It is then keyed firmly to the square shank of the helix and the eye on the end of the rod replaced. The eye serves to hold the wrench firmly in place during the installation. The handles are moved down the shaft to a convenient point and the anchor screwed in until the handles are near the ground. The set screws are loosened and moved up to a convenient position and the operation repeated until the anchor is at the required depth. The eye is then removed and the wrench is pulled out after which the eye is replaced. The guy strand is attached and the pole is anchored, the entire operation consuming not more than 15 or 20 minutes.

Annual Meeting, New England Street Railway Club.

The annual meeting and banquet of the New England Street Railway Club will be held at the Hotel Somerset, Boston, Mass., Thursday, March 22nd. The business session of the club will meet at 3 o'clock p. m. The banquet and after-dinner addresses will be given in the banquet rooms of the Hotel Somerset in the evening. The Hon. W. Caryl Ely, president of the American Street & Interurban Railway Association, and Hon. Geo. Tate Blackstock, Kings Counsel, of Toronto, Canada, are among the speakers of the evening.

New Design of Electric Heater with Junction Box Attached.

The accompanying illustration shows a recent design of double-coil cross-seat electric heater with its junction box directly attached. This design has recently been placed on the market by the Consolidated Car Heating Co. The arrangement of the junction box and switches is such that the conduit is led directly to the heater, thus there are no exposed wires or joints to come loose. At each position of the regulating switch the heat is distributed the full length of the heater. The coils consist of a large amount of low resistance wire continuously supported on porcelain tubes. When arranged for minimum current consumption, the heating coil in one of this type of heaters includes 450 ft. of wire. The total radiating surface



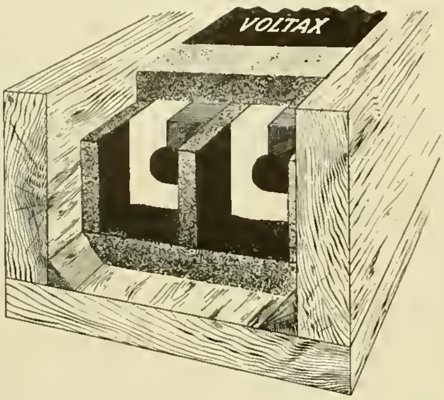
ELECTRIC HEATER WITH JUNCTION BOX ATTACHED.

of the coil and supports exclusive of the cases is 712 sq. in., per heater. By using such a large amount of wire, nearly 10 times as much as in any other construction, an extremely low maximum temperature of 400° is obtained.

The Wabash Ry. is now running through sleepers from Chicago to the City of Mexico in connection with the Iron Mountain route. These cars leave on the limited trains Monday and Thursday of each week. On February 20th and March 6th and 20th the Wabash will sell homeseekers' tickets from Chicago to all of its Southwestern territory. These tickets will be offered for less than half rate for the round trip and F. H. Tristram, A. G. P. A., 97 Adams St., Chicago, will be pleased to furnish maps, time cards and full details to those contemplating such trips.

Improved Underground Cable Construction.

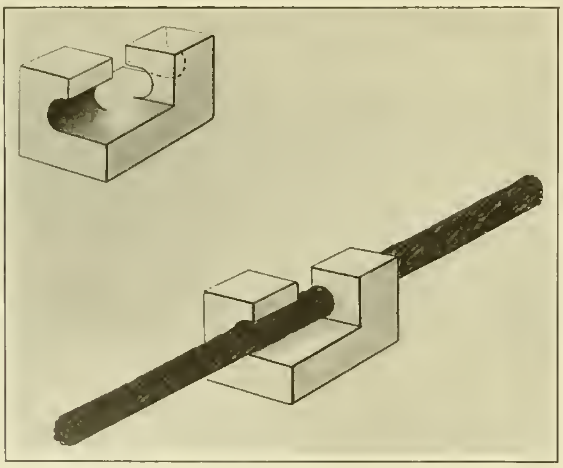
Scarcely any two of the railway companies that are obliged to place their feeder cables underground use the same type of construction. The general plan, however, which is usually modified to meet the particular needs of each distribution system, is to draw the cables into clay ducts laid in a close formation at the bottom of a trench. This method of placing cables requires that each conductor be not only insulated, but protected by a lead sheath.



OPEN END OF TWO-CABLE CONDUIT.

The accompanying drawings illustrate a novel system of underground cable construction which has proved its worth in Germany. This scheme of building conduit is being introduced by the Electric Cable Co., of New York City, which manufactures the insulating compound that plays an important part in the conduit construction.

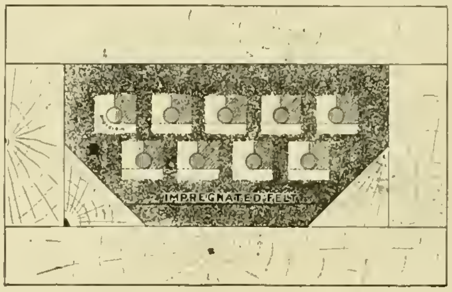
By reference to the illustrations it will be seen that the arrangement of the cables in the trench is a simple one. For installing the ordinary high or low tension feeder system a trench is first excavated to a suitable section. In this trench is laid a wooden box. The cables are supported in their proper position within this wooden trough by insulator blocks or bridges which lock about the conductor as shown in the illustration. These bridges are spaced about four or five feet apart along the cables, and when the conductors have been stretched in place the interior of the box is lined with heavy felt or similar material so spaced as to retain the cables in separate and suitable alignment. When this has been done all the remaining voids in the wooden box are filled with the company's earlier mentioned insulating compound known as



SELF-LOCKING PORCELAIN BLOCK FOR CABLE SUPPORT.

"Voltax." A wooden cover is then placed over the top of the trough and the outside of the woodwork protected by a complete covering of this same compound. As this insulating material remains in a solid condition without hardening or cracking, it is quite impossible for an accidental short circuit to be made within the box. If at any time after the conduit has been installed it becomes necessary to make a connection with the protective cables, this can easily be done by removing a portion of the box cover, melting out the insulating compound with a blow torch when the cables will be ready for making the desired connection. After the tap or splice is finished the conduit may be placed in its former condition by filling the melted-out portion with a small quantity of "Voltax."

There has, heretofore, been an objection made to the solid system of underground cable construction, because of the extra work required to increase the capacity of the conduit as in construction where idle ducts can be laid and added copper drawn in as necessary. This method of construction which has here been outlined is said to cost 25 to 33 1-3 per cent less for a fixed type of construction than the duct system, and it is believed that the



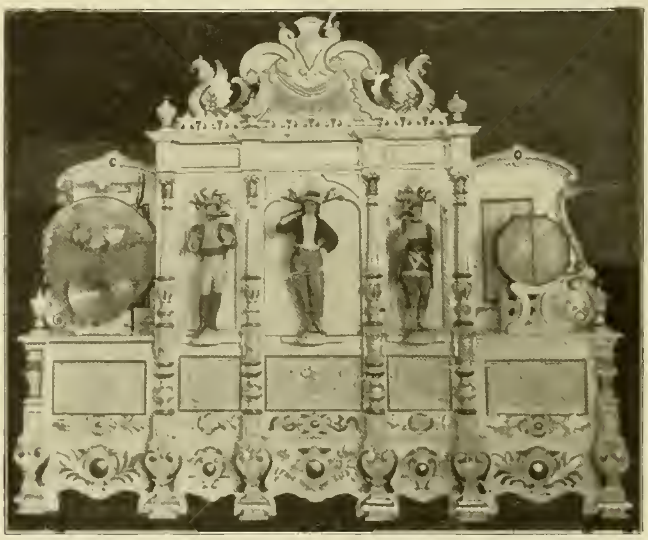
SECTION OF CONDUIT SHOWING ARRANGEMENT OF CABLES.

method will show a far superior reliability. As the maintenance cost is entirely eliminated, a sufficient amount of copper to care for the future increase in load could originally be built in the solid system, and the interest on this extra copper would be appreciably less than the cost of maintenance of extra ducts in the usual type of construction. The total absence of lead sheaths to attract stray currents or present a nearby ground in case of insulating troubles is happily absent from this type of conduit construction.

Music Hath Charms.

In the equipment of an amusement park an orchestra, band or some form of automatic piano or organ is an important item. The public demands music and it has been found that the musical attraction provided is one of the best drawing cards of the park.

Automatic pianos and organs are to be found in not a few of

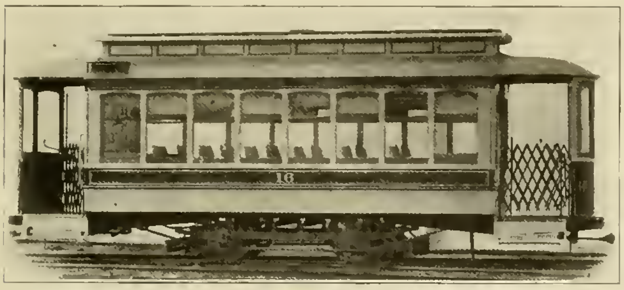


AUTOMATIC ORGAN FOR AMUSEMENT PARKS.

these parks. In their manufacture the firm of Gavioli & Co., of Paris, which maintains an American branch at 495 W. Broadway, New York City, has gained an enviable reputation. The illustration shows one of the types of organs which this company has placed upon the market. As will be seen, the exterior is very attractively decorated, also the tone is sweet and clear and it has been said that the volume of sound produced when in operation is equivalent to a full band of 60 musicians.

New Closed Cars for Lexington, Ky.

The longitudinal-seat car illustrated is one of six recently built for the Lexington Railway Co. by the American Car Co. The second illustration shows one of six grooveless-post, semi-convertible cars of the Brill type recently furnished by the G. C. Kuhlman Car Co., in addition to six which were completed several months ago. The cars will be put in operation at once, as they are badly needed to take the place of 12 closed cars which were burned in the fire which destroyed one of the company's car barns last September. It has been the policy of the company heretofore to use a double equipment of cars, closed cars for winter and open cars for summer



GROOVELESS-POST, SEMI-CONVERTIBLE CAR FOR LEXINGTON, KY.

service, but these semi-convertible cars will be kept in constant operation throughout the year.

The Lexington city system consists of 16 miles of track. The interurban line includes 30 miles in operation and 13 miles which are nearly completed. Lexington is one of the chief railway centers of the interior of Kentucky and besides being important commercially it has several large educational institutions.

The cars built by the American Car Co. measure 20 ft. over the bodies and 29 ft. over the crown pieces. The width over sills, including the panels, is 6 ft. 3 in. and over the posts at the belt, 7 ft. 5½ in. The sweep of posts is 8 in. The distance between the centers of the posts is 2 ft. 9½ in.; the thickness of the corner posts is 3¾ in. and that of the side posts, 1¾ in. The side sills are 4 x 7¾ in. and the end sills 4 x 7 in. The distance from the rail to the step is 15⅜ in., and from the step to the platform, 12 in. The interior finish is of cherry in the natural color with

INTERIOR OF GROOVELESS-POST CAR.

ceilings of maple. The windows are of polished plate, the sashes being arranged to drop into the pockets. The longitudinal seats are covered with velvet carpet. The floors are screwed down instead of being nailed in the usual manner. The central sash of the portable vestibules is arranged to slide to one side. The platform timbers are reinforced with angle irons and the construction is of a substantial character.

The cars of the grooveless-post, semi-convertible type measure 20 ft. 8 in. over the bodies and 30 ft. 1 in. over the crown pieces. The width over sills is 7 ft. 8½ in. and over the posts at the belt, 8 ft. The sweep of the posts is 1¾ in.; center to center distance of posts, 2 ft. 5 in.; height from floor to ceiling, 8 ft. 4½ in.; height from track to under side of sills, 2 ft. 4½ in. and from under side of sills over trolley board, 8 ft. 11½ in. The side sills are 3⅝ x 5 in. in section and the end sills, 3½ x 8⅜ in. Steel plates, 12 x ⅜ in. are placed on the inside of the side sills. The thickness of the corner posts is 3⅝ in. and that of the side posts, 2¾ in. The seats are 35 in. long and the aisles 22 in. wide. Both of these lots of cars are mounted on Brill No. 21-E trucks and are further provided with bumpers, "Dedenda" gongs, "Dumpit" sand boxes,

SIDE-SEAT CAR FOR LEXINGTON, KY.

folding gates, ratchet brake handles and other furnishings of the builders' make.

New Classification of Accounts for Mohawk Valley Co. Reports.

The managers and auditors of the several organizations which comprise the Mohawk Valley Co. are planning to formulate a standard system of accounts which will be satisfactory in reporting the business of the several companies to the parent company. The organization of the Mohawk Valley Co., in which the New York Central R. R. holds a controlling interest, includes the Rochester Railway Co. and its subsidiary companies, the Syracuse Rapid Transit and subsidiary companies, Utica & Mohawk Valley Railway Co. and the Schenectady Railway Co.

When these several properties were purchased by the Mohawk Valley Co. it was found that the State Railway Commission's standards of classification were so broad that it became necessary to formulate a classification in which the accounts included under each head in the reports of these several properties would at all times be made up of like items of the receipts and expenditures. Such uniformity is necessary so that the chief executive of the syndicate, to whom the financial reports are sent, can make exact comparisons between the reports of the several properties.

Tie Treatment as Practiced by the Chicago & Northwestern Ry.

The Chicago & North-Western Railway Co. has recently introduced an interesting innovation in railway circles by issuing its "North-Western Bulletin," a publication devoted to the interests of the company and its employes. Each superintendent of the company has appointed two representatives from his division who have charge of the collection and compilation of news which will appear in the columns of the "Bulletin" and it is expected that much benefit will result to all concerned.

We are pleased to reproduce some of the good words regarding railroad ties which appeared in the March issue of this paper:

"Each year 200,000 acres of forests are cut to supply ties for the railroads of this country. Each year 15,000,000 ties are required which are worth 35 cents each, making an aggregate of $5,250,000. Near Escanaba, Mich., the Chicago & North-Western has established a plant for the treatment of railway ties, equipment being provided for treating about 1,000,000 ties per annum, the cost averaging 15 cents each. A four per cent solution of chloride of zinc is used, and after the wood is thoroughly impregnated with this, a mixture of glue and tannin is forced into the pores in order that the solution may not leak out."

Personal.

MR. J. T. WILSON has been elected treasurer of the Cleveland & Southwestern Traction Co., with offices at Cleveland, O., succeeding Mr. F. L. Fuller, resigned.

MR. F. J. BOEHM has been appointed auditor of the Milwaukee Electric Railway & Light Co. with offices at Milwaukee, Wis., succeeding Mr. H. C. Mackay, resigned.

MR. HARRY YOUNG, recently assistant passenger agent of the Rock Island R. R., has been appointed general passenger agent of the Lake Shore Electric Railway Co., with headquarters at Norwalk, O.

MR. L. T. GIRDLER, recently assistant general manager of the Muskegon Traction & Lighting Co., has resigned his position. Mr. Girdler was formerly an engineer for the Standard Cable Co. of Pittsburg, Pa.

MR. F. B. HUNTINGTON, vice-president and secretary of the Eastern Wisconsin Railway & Light Co., has resigned, to accept the position of comptroller of the Chicago Terminal Transfer Railroad Co. of Chicago.

MR. G. F. CURRIER has been appointed division superintendent of the Kalamazoo city lines of the Michigan Traction Co. He has been connected with the lines in different capacities for 12 years and had a year's experience in street railway operation before coming to Kalamazoo.

MR. D. G. EDWARDS, who was, until Nov. 1, 1905, passenger traffic manager of the Cincinnati, Hamilton & Dayton R. R., has recently assumed his duties as vice-president in charge of the Schoepf-Morgan-McGowan Traction system, controlling various lines in Ohio and Indiana.

MR. THEODORE STEBBINS, who has been general manager for the receivers of the Appleyard lines, has left Columbus to take up the duties of his new office with the public ownership commission of the National Civic Federation. Mr. Stebbins' successor has not been named.

MR. C. E. MORGAN, purchasing agent of the Indianapolis & Eastern Railway Co., has been appointed superintendent of the Indianapolis & Martinsville Rapid Transit Co. and the Indianapolis & Plainfield Traction Co. He will continue as purchasing agent of the Indianapolis & Eastern Railway Co.

MR. S. E. WOLFF, who has managed the properties of the Bartlett Illuminating Co., the Saginaw Valley Traction Co. and the Saginaw City Gas Co., since December 1st, has been recently elected to a place on the board of directors and has been chosen vice-president of the combined companies.

MR. J. A. BUCKNELL, who was for many years freight and ticket agent of the Grand Trunk Ry., and who has been for the past three years general freight and passenger agent of the Jackson & Battle Creek Traction Co., has been given charge of the traffic over the Mills-Moore-Elliott Syndicate lines.

MR. W. A. GIBBS, recently general manager of the Zanesville Railway Light & Power Co. of Zanesville, O., has been appointed general manager of the Columbus, Newark & Zanesville and the Columbus, Buckeye Lake & Newark companies, succeeding Mr. J. R. Harrigan, who has become general manager of the Canton-Akron system.

MR. J. H. MERRILL, who has recently been appointed secretary of the Central Electric Railway Association, was tendered a banquet at Lima, O., upon the eve of his departure for Indianapolis to take up the work of his new office. The banquet was given him by a number of his intimate friends and was an occasion of considerable enjoyment to all concerned.

MR. S. E. WILLIAMS, recently secretary of the Rapid Transit Railway Co., of Dallas, Tex., has resigned to become associated with the Jacksonville Electric Co., of Jacksonville, Fla., as manager. Mr. W. H. Tucker, formerly manager and purchasing agent of the Jacksonville Electric Co., has been transferred to Dallas to assume the management of the company there.

MR. B. K. HOUGH has been appointed the New York representative of the Mayer & Englund Co. of Philadelphia, succeeding the late Mr. Beach, whose death was recently noted in the columns of the "Street Railway Review." Mr. Hough was graduated from Cornell in 1897 after which he became associated with the Boston Electric Light Co., and was with Stone & Webster for a period of four years. In 1901, he was appointed sales engineer for the Stanley Electric Co. in New York City and later became chief sales engineer for that company. He has recently been connected with the New York Edison Co. and with the firm of Ford, Bacon & Davis.

MR. C. D. EMMONS, general manager of the Ft. Wayne & Wabash Valley Traction Co., has accepted one of the new positions on the state executive board of the Indiana Young Men's Christian Association, recently created by the state convention of the association. His chief duty will be in connection with the traction interests of Indiana in the railroad department committee.

MR. MASON B. STARRING, general solicitor and general manager of the Chicago City Railway Co., has been also elected vice-president of the company. Mr. J. B. Hogarth, formerly auditor of the Denver City Tramway Co., of Denver, Colo., has been appointed secretary and auditor. Mr. J. B. Burke, formerly the assistant treasurer, has been elected treasurer of the company.

MR. A. M. FRAZEE has resigned his position as superintendent of motive power of the traction line of Newark, O., to accept a position with the Tucker-Anthony Co. of Duluth, Minn. Mr. Frazee will superintend the construction of a large power house at Cloquett, Minn., about 20 miles from Duluth, which is intended to furnish power for the street railways of Duluth, Minn., and Superior, Wis.

MR. WARREN P. BRISTOL, general manager of the Meriden Electric Ry. of Meriden, Conn., has been appointed acting general manager of the Hartford lines of the Consolidated Railway Co. He succeeds Mr. Frank Caum, who has accepted the position of general manager of the Scranton Ry. Mr. Bristol has been manager of the Meriden Electric Ry. since November, 1895, when he succeeded Mr. W. C. Gray.

MR. F. D. CARPENTER, general manager of the Western Ohio Railway Co., announces several promotions in his office force. Among these is that of Mr. R. H. Carpenter, who succeeds Mr. J. H. Merrill as auditor and purchasing agent. His place has been filled by Mr. C. F. Price who has been the advertising agent of the road. Mr. C. C. Collins has been appointed to fill the newly created office of freight traffic manager.

MR. HERBERT A. FAULKNER has succeeded to the position of passenger agent to the Boston & Northern and Old Colony Street Railway companies, which office was recently vacated by Mr. Robert H. Derrah. Mr. Faulkner has been actively engaged in daily newspaper work for the past 12 years. For the past five years, he has been successively the city editor of two Brockton papers, the "Times" and the "Enterprise." His home is in Brockton, Mass.

MR. W. M. BONAR, formerly of the auditing department of the Wabash R. R., and who was appointed auditor of the Columbus, Buckeye Lake & Newark and allied lines several months ago when these roads passed to the Schoepf syndicate, has been given supervision over the auditing department of the former Appleyard lines now owned by the Morgan-Dolan-Schoepf Syndicate. The entire department will probably be moved to the Cincinnati headquarters.

MR. C. N. DUFFY has severed his connection with the Chicago City Railway Co., as secretary and auditor. Mr. Duffy has had an extended and varied experience in the street railway business. He was one of the organizers of the Street Railway Accountants' Association of America, was president of the association from 1899 to 1900 and is chairman of the committee on standard classification of accounts and chairman of the committee on international forms of reports.

MR. JOHN J. STANLEY, vice-president and general manager of the Syracuse Rapid Transit Railway Co. and general manager of the Cleveland Electric Railway Co., has been recently elected to the additional office of first vice-president of the latter company. Mr. Stanley will have entire charge of the Cleveland lines in the absence of President Andrews, who will give a large share of his time in the future to the Andrews-Vanderbilt trolley interests in the state of New York.

MR. J. M. WALKER has been appointed chief engineer of the Lima & Toledo Traction Co. Mr. Walker was, in 1896, assistant engineer on the construction of the New Castle Street Ry., of New Castle, Pa., afterward becoming chief engineer and superintendent of power houses and equipment. When that property was merged with the Mahoning Valley Railway Co., he retained his position and in

1904 was made chief engineer in charge of power houses, car barns, overhead construction, track and buildings. He resigned that position to take up his present work.

MR. E. R. MASON, vice-president of the electrical supply company of Porter & Berg, Chicago, Ill., has been in the Lakeside Hospital for the past six weeks, as the result of an operation for appendicitis. Hs is now rapidly recovering and hopes to be able to resume his duties within the coming month.

MR. E. E. DOWNS has resigned his position as general manager of the Petaluma & Santa Rosa Railway Co. Mr. Downs has had an extended experience in electric railway business. In 1903 he was vice-president and general manager of the Winnebago Traction Co. of Oshkosh, Wis., and later was elected president of this company. He resigned his position in 1904 to take up his work with the Petaluma & Santa Rosa Railway Co. Mr. Downs will shortly return to the East.

MR. ROBERT H. DERRAH, who has been connected with the Boston & Northern and Old Colony Street Railway Companies for some time as passenger agent, has resigned. Mr. Derrah leaves the service of the companies to carry out other business plans. He has had a large and varied experience in street railway matters and the companies were particularly fortunate in securing his services. That fact was made apparent by the popularity of the passenger office where hundreds of people called daily during the summer months in search of information.

Obituary.

MR. GEO. W. LITTLE, recently assistant treasurer of the Pittsburg Spring & Steel Co., died on Friday, February 16th, of pneumonia, after an illness of one week. Mr. Little was connected with the firm of A. French & Co. for some 30 years prior to the year 1902, when he became assistant treasurer of the Pittsburg Spring & Steel Co., which position he held until the time of his death. His extended experience in the spring business made him a valuable member of the company. His death is a great loss, not only to his immediate associates but also to the broad circle of friends in which he was held in high esteem.

MR. M. STEIN, formerly head of the freight department of the Western Ohio Railway Co., was killed in a collision which occurred on the Western Ohio Railway lines on the morning of February 19th. This was the first fatality resulting from a collision since the road has been built. Mr. Stein had been in the employ of the company since the line was opened between Sidney and Piqua. He was considered one of the best men in the service. After coming to Lima he made many friends and the announcement of his untimely death caused much grief among his old associates.

MR. JAMES PARTRIDGE, recently manager of the plant of the National Carbon Co. at Sandusky, O., died suddenly in his office Saturday morning, March 10th. Death was caused by heart failure. Mr. Partridge came to Sandusky from Pittsburg in 1890, and with John Spear, organized the Partridge Carbon Co. By means of some valuable patents, the company did a thriving business and in 1899 it was purchased by the National Carbon Co., Mr. Partridge being retained as manager. He was born in Birmingham, England, in 1854.

The New York, New Haven & Hartford R. R. has raised the wages of conductors and motormen from $2.50 to $2.60 per day.

Work on the Omaha & Southern Interurban Railway Co. has been started. Shackleford & Peterson, of Omaha, Neb., is the contractor and is under contract to have the grading between South Omaha and Bellevue completed by summer. The new road is to extend from South Omaha to Fort Crook, through Bellevue. While it is an independent company it is under the same management, and has the same board of directors as the Omaha & Council Bluffs Street Railway Co. Cars are to run at first from Fort Crook to a junction with the Omaha cars, and will eventually run into Omaha. It is planned to run an express car to deliver small packages to residents along the route of the new road as well as to Bellevue and Fort Crook.

Electric Signs as Money-Makers in Amusement Parks.

One of the most attractive features of the numerous amusement parks, which are being built in all parts of the country, is the electric lighting display and not the least important part of this display is included in the electric signs. In the last issue of the "Street Railway Review," which was largely devoted to park descriptions, attention was directed to the electric advertising signs used by the Louisville & Southern Indiana Traction Co. in its "Glenwood Park" at New Albany, Ind. This enterprising company has distributed a number of electric signs throughout the park, the rental of which adds substantially to the company's revenue and at the same time reduces the cost of lighting the park. These amusement parks constitute investments of a permanent nature and it is quite important to provide a sign that will be both durable and attractive.

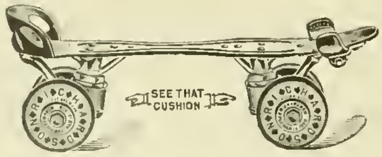
Such a sign is placed on the market by the Federal Electric Co., Chicago, Ill. This company makes a specialty of metal signs, the sign faces being of porcelain enameled steel, a material which is well known for its durability. It consists practically of glass, fused into the face of the steel and it is claimed that by reason of this combination, the sign will not lose its color or finish. On account of its excellent reflecting power, this material permits the use of a lamp of lower candle power than can be used on the ordinary painted sign. It is unnecessary to repaint a sign made of this material, as it can be washed clean at any time with a damp rag.

ONE OF THE SIGNS MANUFACTURED BY THE FEDERAL ELECTRIC CO.

In the manufacture of these signs, one of which is illustrated, the company uses a special clamp socket designed for outdoor use and having a lamp shell of pure copper which can be removed from the front. The porcelain projects a considerable distance beyond the lamp shell thus protecting the base from the weather and effecting a considerable saving in lamp renewals. These sockets are also useful in various kinds of decorative work, as they can be clamped to sheet metal and used for outlining buildings or for studding ceilings. It is less expensive to attach these sockets than any socket with which it is necessary to use screws or bolts. The weatherproof styles of these sockets are made into festoons which may be rented or purchased. They are furnished with small porcelain enameled shades which protect the lamp from the weather.

Roller-Skating Rinks in Amusement Parks.

The exhilarating sport of roller skating has become one of the most popular forms of amusement in the country and there is every indication that the present revival of the pastime will continue for many years. The installation of a roller-skating rink in amusement parks has been found, in the majority of cases, to be a source of considerable additional revenue. A number of these rinks are equipped with the Richardson skates which are manufactured by the Richardson Ball-Bearing Skate Co., 501 Wells St., Chicago, Ill. These skates have given entire satisfaction wherever introduced.



THE RICHARDSON SKATE.

The skates are durable and quite simple in construction. The foot plates are made from the finest quality of 15-gage cold rolled steel in one piece. An important feature in connection with the construction of these skates is the large rubber cushions placed between the roller carrier and the foot plate on which the skater rides, the yielding action of which eliminates all excess vibration and prolongs the life of the skate. These cushions also make it possible to use the skates on the finest dancing floor without injuring it, and the noiseless running is also due to the use of these rubber cushions. The skates are equipped with steel, aluminum or wooden wheels and are made in a variety of types. The company manufactures these skates for rink use exclusively.

A very attractive catalog has recently been issued by the company which contains, besides descriptions of its various products, some interesting matter on the subject of "How to Open and Conduct a Roller-Skating Rink."

Single-End Combination Cars for the Illinois Traction System.

The Illinois Traction System in accord with its many extensions and improvements has recently ordered from the St. Louis Car Co., seven single-end, combination passenger, baggage and smoking cars. These cars constitute a fine equipment and a description of some of the more important details of construction follows.

NEW COMBINATION CAR FOR THE ILLINOIS TRACTION SYSTEM.

The cars have an over-all length of 51 ft. 6 in., and an over-all width of 9 ft. ½ in. The length of the passenger compartment is 27 ft. 9¼ in., the length of the smoking and baggage compartment, 17 ft. 4 in. and the length of the rear platform, 4 ft. 8½ in. The framing is of the standard type. The side sills are of yellow pine 5 x 7¾ in., reinforced by steel plates, 7 x ⅝ in. in section; the sub-side sills are of yellow pine, 2¾ x 6 in.; the center and intermediate sills are composed of 6-in. I-beams filled in on both sides with yellow pine mortised to receive the tenons of the cross sills. The cross sills are also of yellow pine, 3½ x 4 in. The bolsters are of the truss-plate type, the plates being 10 in. wide.

The platforms are constructed of heavy oak timbers reinforced by steel angles extending from the ends of the car to the body bolsters. The sides of the car are sheathed horizontally with ⅞-in. yellow pine boards covered with 2-in. wide poplar boards ½ in. thick, glued to the horizontal boards. The entire side of the car is tied together by ⅝-in. tie rods in each post and there are also diagonal braces between the posts.

The steps are suspended by steel hangers and are provided with safety treads. There are sliding doors in the rear end of the passenger compartment, swinging doors in the partitions, double folding doors on either side of the vestibule and one four-foot sliding door on either side of the baggage compartment. The interior finish of these cars is of mahogany decorated with inlaid marquetry lines. All interior panels are finished with figured mahogany veneer. The ceilings are semi-empire in shape and are painted a light green. Plate glass is used in the windows, the upper sash being Gothic in shape and fitted with green opalescent glass. The deck sash is also of opalescent glass. The seats are of the high-back type, those in the smoking compartment being covered with leather. The cars are heated by a hot-water apparatus placed in the passenger compartment and there is a toilet in the rear of each car.

The motorman's cab is placed in the left hand corner of the baggage compartment. The equipment includes four 75-h. p. motors, bronze vertical brake wheels, air sanders, air brakes and a multiple control system.

STREET RAILWAY REVIEW

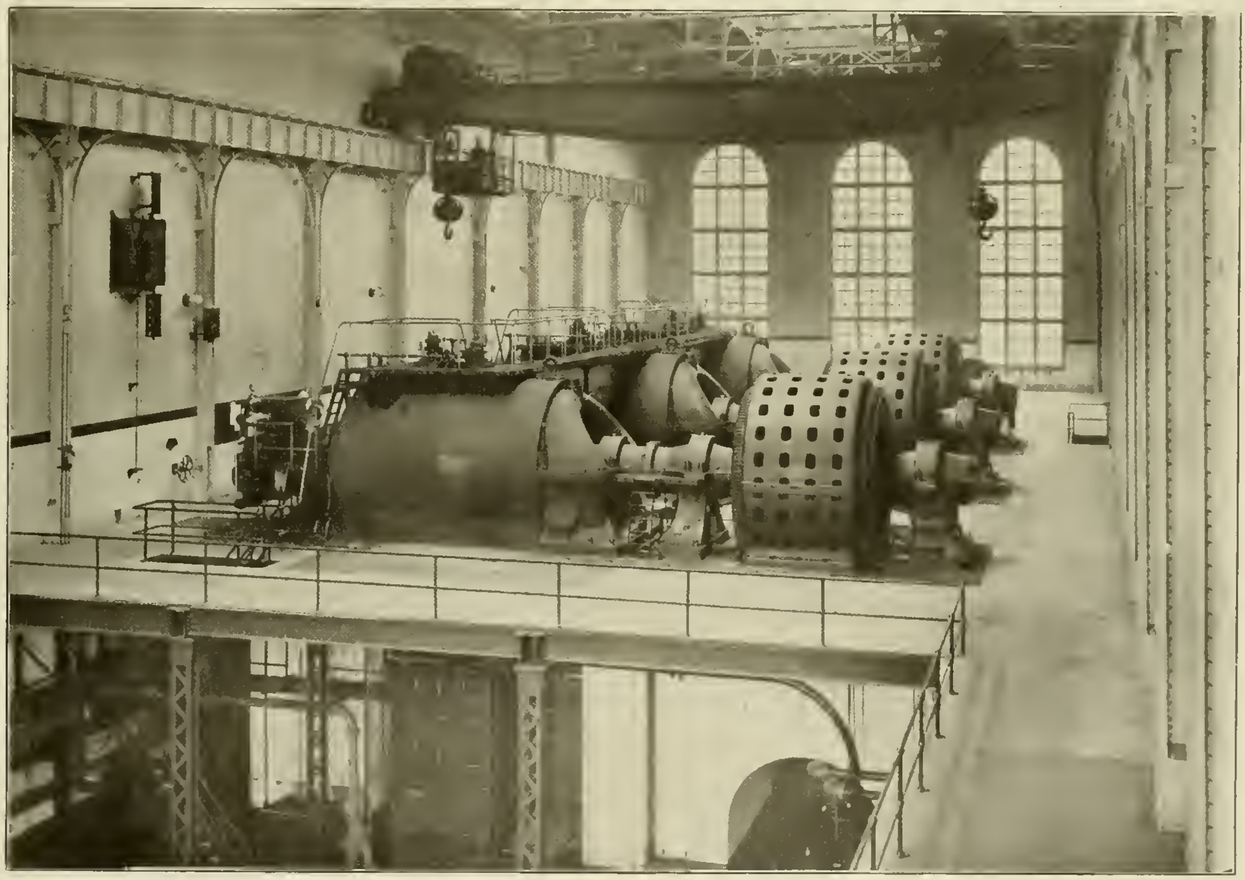
Vol. XVI APRIL 15, 1906 No. 4

The Long Island City Power Station of the Pennsylvania Railroad Company's Extensions to New York and Long Island.

The Pennsylvania Railroad Co. has had under consideration for a number of years plans for establishing a terminal for its lines on Manhattan Island. The earliest of these contemplated a bridge over the Hudson River with elevated approaches and a terminal in the city of New York. The demonstration that electric traction was practicable for heavy train units made possible an entrance by means of tunnels, which would enable the adoption of a well rounded out plan for a terminal embracing not only the Pennsylvania R. R. main line business, but the through connection with New England and the railroad system on Long Island.

The magnitude of the terminal system of the Pennsylvania R. R., which is to be entirely operated by electric power necessitated that, on the score of reliability of service and convenience of power distribution, there should be two main generating stations, sites for which could the more readily be obtained if they should be located, one in New Jersey and the other on Long Island. The latter station would also naturally be used as the main source of power for the Long Island R. R. lines as fast as equipped.

On account of the very large amount of power that will eventually be needed by the new lines, it was thought desirable to build the power station near the location which will eventually be the electrical center. The proximity of the East River was so advantageous for both condensing water and cheap coal delivery as to determine the selection of a situation abutting it. Such a site was fortunately available in Long Island City. It consists of an entire rectangular block with the short side toward the river, extending 200 ft. north and south on Front St. and on West Ave. and 500 ft. in depth along Third and Fourth Sts.



VIEW IN ENGINE ROOM SHOWING GENERATING UNITS WITH CONDENSER EQUIPMENT UNDERNEATH—LONG ISLAND CITY POWER STATION.

At the time the design was made, the largest size of steam turbine and generator that had been standardized was of 5,500 kw. capacity, and this size became the unit basis of the power station design. The rectangular shape of the lot made it possible to plan a station that could readily be extended to accommodate 14, 5,500-kw. generating units in the building covering the block or about 105,000 e. h. p.

For the initial load it was decided that three 5,500-kw. units would

suffice. The building, as designed for this initial equipment, covers the full width of the block and half its length and contains room for six 5,000-kw. units, and two 2,500-kw. units to be used for lighting the tunnels.

Foundations and General Construction.

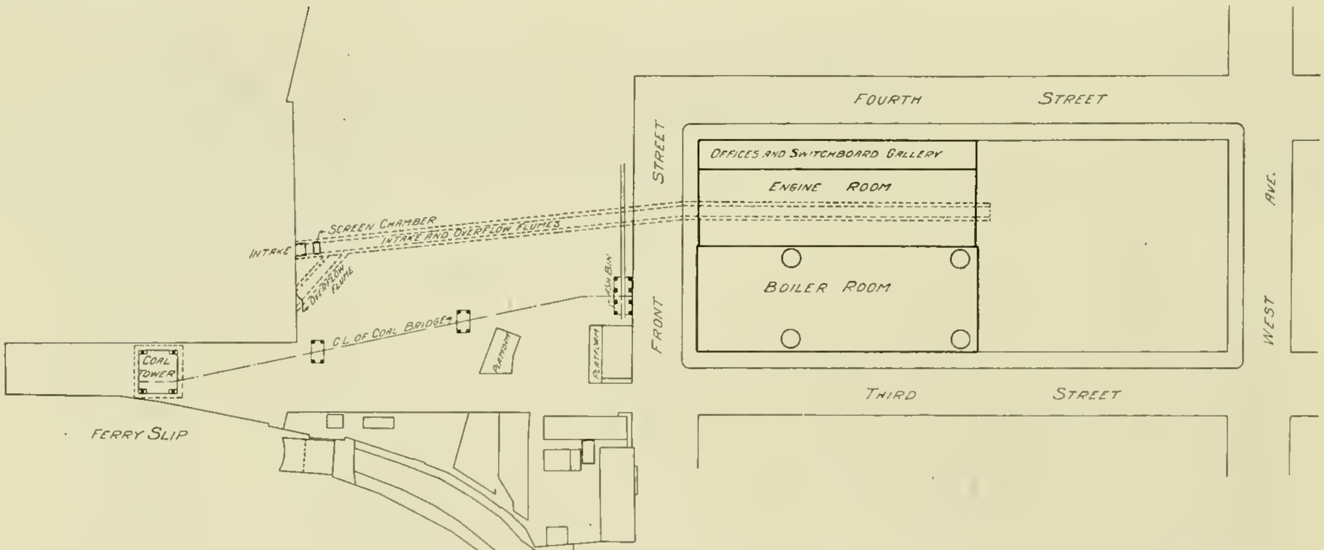
The power house site was formerly under water and had only been filled in to an extent that brought the surface about 1½ ft. above the extreme high water. After due consideration it was decided to use for a foundation, a comparatively uniform spacing of piles overlaid by a monolithic concrete mass of a thickness which would equal the distance between the point at which the piles could be safely cut off and extreme high water. A comparative study of the monolithic and disconnected type of foundation showed that the monolithic type was much less expensive.

The foundation is designed to carry a load of 12 tons per pile and the spacing of the piles is on an average of 2 ft. 4 in. between centers over the entire area. The concrete cap on the tops of the piles is 6 ft. 6 in. thick which has enabled the cutting off of the piles 2 ft. 6 in. below high water level, in a water-bearing stratum of river mud, thus insuring perpetual moisture sufficient to preserve the piles from decay. Underneath the stacks, the concrete cap is 8 ft. 6 in. deep, the piles being cut off 2 ft. lower down. The stack anchor bolts pass through a grillage of steel T-rails, embedded in the bottom of the concrete, making a very firm foundation.

The intake being underneath the overflow, the circulating water must be lifted from it, past the overflow flume, and to accomplish this a well is provided in the concrete foundation reaching down from the surface of the concrete cap to the bottom of the intake flume. The circulating water discharge pipe from the condenser drops directly into the overflow flume.

The concrete for the flumes and foundation was mixed by machine in a special plant. The mixture was in the proportions of 1, 2½ and 5, very wet, and required very little ramming. The entire block of concrete required for the monolithic cap and the flumes, was about 18,000 cu. yds. Under favorable conditions the mixing capacity of the plant was as high as 100 cu. yds. of concrete per hour.

The building was erected free from any architectural elaboration. The design of the power station building includes three distinct features which are clearly illustrated in the exterior view. The first is the boiler house with its four independent stacks piercing the roof at regular intervals and its facade exhibiting the subdivision of the structure into a series of equal bays, each marked by a single arched window opening, extending without interruption past all floors. The second feature is the separate enclosure of the coal bunker superimposed by the boiler house longitudinally between the stacks. The third feature is the engine house including also the electrical switching galleries and offices, which is treated as a separate wing of the entire building connected to and



MAP OF POWER HOUSE SITE AND SURROUNDING PROPERTY.

The flume for the condenser intake, and the overflow flume directly above it, traverse the building foundations completely from west to east and are integral with it. Both the intake and the overflow flumes are of concrete and nominally 10 ft. in diameter, this large sectional area being required to provide sufficient condensing water with a low velocity of flow when the power station is extended to its future maximum size. The elevation of the intake flume is such that it is always submerged. At a point 50 ft. from the bulkhead the tunnels separate, the overflow tunnel passing at an angle of approximately 45 degrees with the center line of the intake. The intersection of the overflow with the bulkhead has been made oblique with the object of producing a long, slow flow at the outlet. The spillway of the flume is formed up into a dam, the object of the dam being two-fold; to insure a water seal on the discharge pipes of the condenser circulating system, and to spread the warm water on the surface to prevent freezing in winter.

At the bulkhead line, the intake is provided with an ice fender extending to a point below the extreme low water. The face of the rack is inclined so that floating objects drawn in by the current can easily be removed. Behind the rack is a screen chamber or well, with two sets of screens fitted in vertical cast-iron guides. A 30-in. connection from the overflow into the screen chamber is so placed that under severe winter conditions, warm water may be run through on to the the screen to prevent an accumulation of ice within the intake chambers.

The condensers are placed directly under each turbine foundation.

parallel with the boiler house. The arched facade of the superstructure rests upon a simple and rugged basement of rough-hewn granite with comparatively small and heavily grated window openings. Above the basement, the walls are constructed of a good grade of repressed red brick laid in white mortar. Bull-nosed brick are used on all corners and reveals to soften the sharpness of the edges. The roof and floors throughout the station building are of concrete, reinforced on the Ransome system and carried on the steel framework of the building.

The frames of all doors and windows in the exterior walls are of cast iron. The main entrance doors are of heavy oak and plate glass. All other doors are built of wood cores covered with iron. The window sashes are of cast iron, glazed with rough wire-glass, the sash being pivoted at the top and arranged to swing outward by a system of operating devices specially designed for this station.

The design of the sanitary appliances of the station received not only careful consideration with regard to the convenience of location, but with a view to securing the greatest possible perfection of material and workmanship.

The overall dimensions of the present building are 200 x 262 ft., outside measurement. The boiler house is 103 ft. wide inside, the engine room 66 ft. and the electrical galleries, 25 ft. wide. The boiler house proper is 82 ft. high. The coal pocket enclosure, superimposed on the boiler house, is 60 ft. wide, and its parapet is 118 ft. high. The engine room is 70 ft. high. The first floor

of the boiler house is 16 ft. above the basement and the second floor of the boiler house is 35 ft. above the first floor. In the engine house, the engine room floor is 23 ft. 6 in. above the basement and thence to the roof trusses the height is about 40 ft. in the clear.

The superstructure of the building consists of steel framework which carries the weight of the roof and the entire contents of the building, excepting such portions of the machinery as may be more conveniently carried on separate foundations. The south wall of the boiler house supports the outer ends of the boiler room roof trusses on that side of the building, but in other respects the superstructure is independent of the building walls.

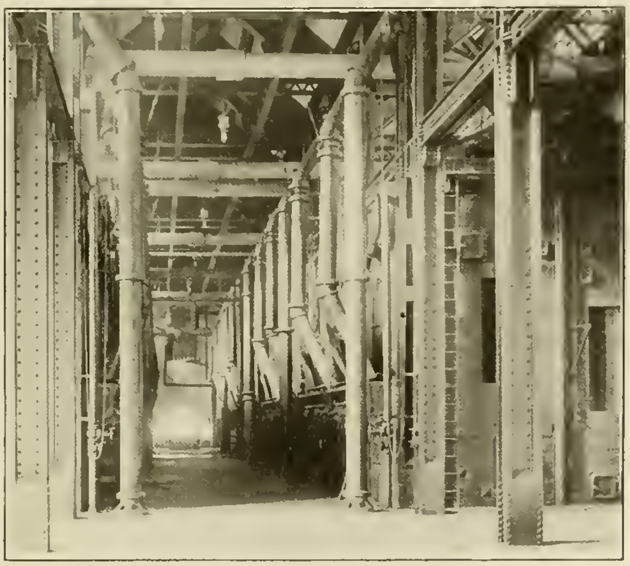
The general design of both the building construction and the arrangement of its equipment is clearly shown in the cross-sectional view through the engine room, boiler house and coal pocket.

Coal and Ash Handling.

The coal and ash handling structure consists of three parts; the coal hoisting tower, the bridge supporting the cable railroad, and the ash bin structure which is so arranged that it forms a part of one of the piers of the cable railway bridge. This level bridge is 107 ft. above the dock and is at about two-thirds the entire height of the tower whose top is 170 ft. above the dock.

From the foundation up to the level of the cable railway the width of the superstructure of the coal tower is nearly the full width of the dock. The structure consists essentially of four heavy corner columns of the box pattern thoroughly braced to each other in all directions except below the engine room floor, where the latticed bracing is omitted in order to accommodate the railroad equipment on the three tracks passing through the tower along the dock. The floor supporting the hoisting apparatus is 25 ft. above the dock and the space over this floor is enclosed for a height of 14 ft. forming an engine room for the hoisting mechanism. The sides of this engine room are made of expanded metal and plaster and the roof of cinder concrete, tar and gravel.

The upper third of the tower, extending above the level of the cable railway, carries the hoisting boom, the receiving hopper, coal crushing and weighing apparatus and the cable railway machinery. It is about half the width of the lower two-thirds of the tower, but



FIRING SPACE BETWEEN BOILERS ON THE SECOND FLOOR.

in other respects is similar in construction. The boom is 68 ft. long over all and projects 43 ft. over the slip at an elevation of 162 ft. above the dock. It supports the trolley carriage from which the hoisting bucket is suspended, and over whose drums the hoisting cables operate. For about 34 ft. above the level of the cable railway, this upper third of the tower is completely enclosed with corrugated copper sheathing, forming a house with two stories, the lower one of which contains the weighing mechanism and the engines driving the crushing machinery, the cable railway and the upper story containing the crusher. Over the crusher is the receiving hopper constructed of heavy steel plate

Between the coal tower proper and the boiler house structure a distance of about 500 ft., there are four spans of bridge construction supporting the cable railway for the coal cars.

The ash bin is directly across the street from the boiler room and ashes are delivered to it through a bridge by means of a telpherage system which hoists and transports the ash cars from the boiler room basement up to the level of this bridge and thence across into the tower where the contents are dumped into the bin. The bottom of the bin is 20 ft. above the railroad track that runs through the

GENERAL VIEW OF THE POWER STATION AND ASH TOWER.

base of the tower and the ashes are handled through dumping gates into gondola cars standing on this track. The capacity of the bin untrimmed is 300 tons. The bin is of steel column construction, thoroughly braced. The bin itself consists of an enclosure of brick walls built around these supporting columns. All the steel work inside and outside is covered either by brickwork or by reinforced concrete. The roof of the ash bin is composed of reinforced concrete slabs, similar to the roof construction of the power station.

The General Features of the Power Station Equipment.

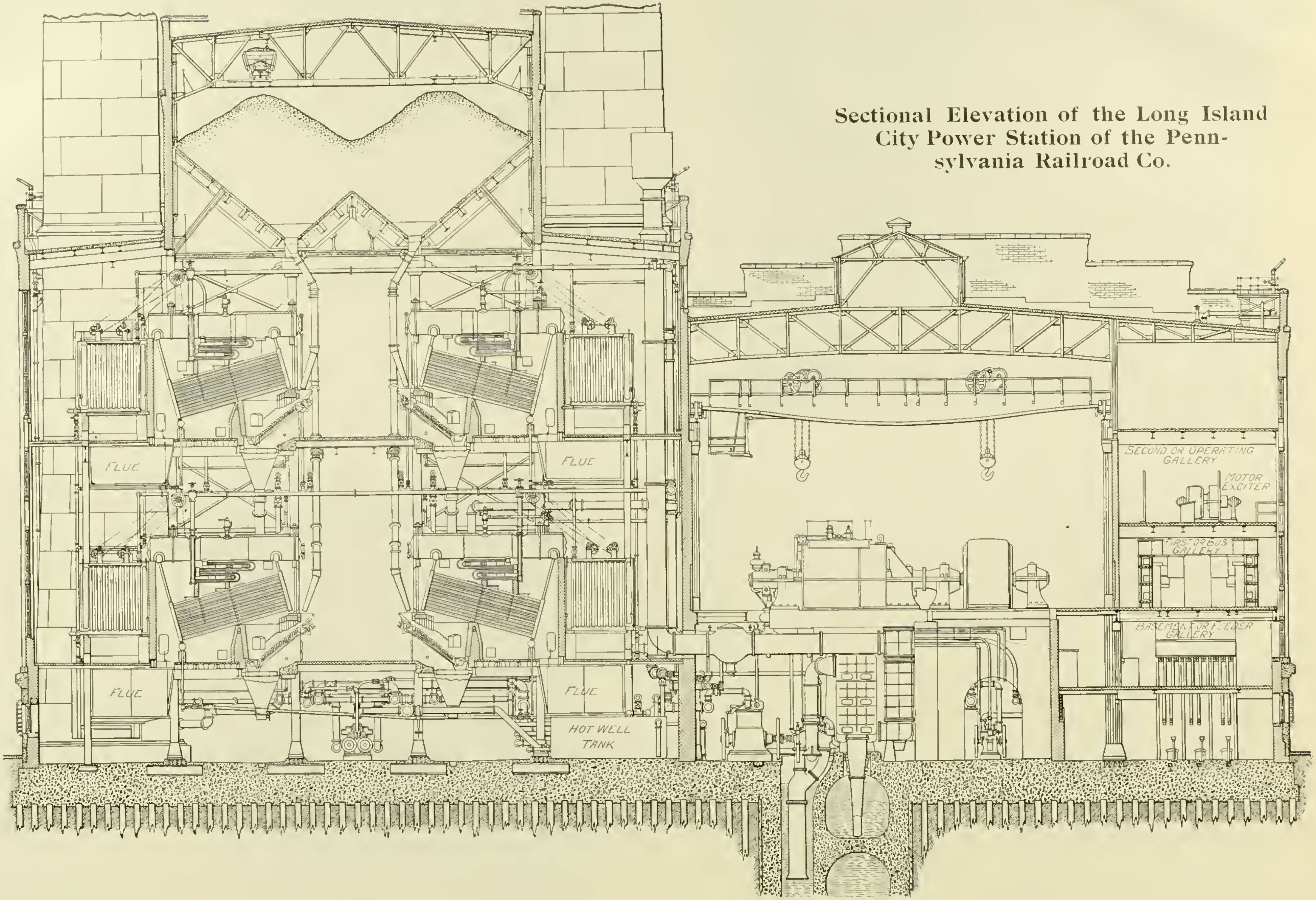
The unit system of design was followed in laying out the equipment of the power station. The boiler plant of 32 boilers is divided into eight groups of four boilers each, four of these groups being on the first floor and four directly over them on the second floor of the boiler house. The four boilers of each group stand opposite each other across an alley or firing space, and are separate as regards economizer, flue and stack connections, but their steam connections are made up of manifolds and vertical headers so as to form them into a group for the purpose of unit subdivision. One group furnishes steam to the two 2,500-kw. lighting units. The other groups of four boilers on the first and second floors are piped together in like manner so that they can, as individual groups, supply steam to their respective 5,500-kw. turbo-generators. These main groups of boilers are piped together by a cross-connecting header which is to be considered as an equalizer.

Coal Handling Plant.

The location of the power station is such that it can receive coal either by water or by rail, but the plant was designed more particularly to deal with water coal, though certain provisions will admit of handling railroad coal directly from the cars.

The location alongside the dock to which barges are brought is about 500 ft. from the west front of the boiler house. A high level cable railway runs from the coal hoisting tower on the dock into and through the top of the boiler house, over the coal pocket, at an elevation of 107 ft. above the dock level. This cable railway is in the form of a loop and is operated by an endless cable, motion being imparted to the cars by means of a simple form of cable grip. After this single hoisting operation, the coal is passed along to its destination in the pocket by gravity and by transportation in cars along the level cable railway. The hoisting tower is of the "one-man" type, having capacity for 400 long tons of run-of-mine bituminous coal in five working hours. In general, the

Sectional Elevation of the Long Island City Power Station of the Pennsylvania Railroad Co.



apparatus is a simple application of heavy, rugged steam hoisting engines of standard type, with an arrangement of ropes, sheaves and counterweights similar to that in satisfactory use for years past in the best steam elevator practice. The coal is hoisted in a two-ton bucket of the "clam-shell" type, with heavy renewable steel cutting blades. The receiving hopper is built of steel plate and the coal passes through it by gravity on to the shaking bottom which allows certain small coal to pass around the crusher to the loading hopper and delivers the large coal to the crusher. The shaking grate and the crusher are operated by the same engine.

The crusher has a capacity of 400 tons in five hours, and the coal after passing through it drops directly into the loading hoppers which are directly above the scale platform. They are equipped with gates operated by the weigher who regulates the movement of the cars. The scales have a capacity of five tons.

The cable railway is designed for handling 150 tons per hour, when operating 29, two-ton cars at a speed of 180 ft. per minute around a track loop approximately 2,500 ft. long. The cable is ¾-in., six-strand wire rope. The engine driving the cable is under manual control and, together with the crusher engine, is in a little engine room on the same level and adjacent to the scales, so that the entire mechanical outfit of this part of the plant is controlled by one man. These engines are of the 7½ x 7-in., Westinghouse standard type, and can be shut down automatically if the cars are not properly released from the cable, just before reaching the loading platform on the return journey where the cable leaves the roadway in order to come over the winding drum. At this point there is situated an automatic tripping device for releasing the grips so that they do not require attention when they arrive empty from the coal pocket.

It is estimated that the actual cost including labor, supplies, and fixed charges per ton of coal from the time it leaves the barge until it arrives in the bin, on the basis of 480 tons per day, is 9 1-3 cents per ton, which is believed to represent the greatest economy yet obtained by any plant intended to accomplish the same purpose under similar general conditions.

Ash Handling System.

Ashes are dumped through hoppers in the bottom of the stoker pits into small cars so constructed that the body is detachable from the truck. After receiving a load of ashes the car is run along a narrow-gage railway laid in the basement floor underneath the line of dumping hoppers to a turntable at the west end of the boiler house basement directly under the end of the ash bridge. A trolley hoist is provided which runs on a 10-in. I-beam that extends from a point over the ash bin through the bridge and over the turntable. From the trolley carriage are suspended, by means of wire cables, two sheaves with forged steel hooks which are inserted in the rings at each end of the car body as it stands on the turntable in the basement. The cables are then wound up on the grooved winding drums of the trolley hoist, raising the bucket to the proper height opposite the ash bridge, at which point, by the action of an automatic switch, the operation of the hoisting is stopped, the trolley motion is started and then the bucket is carried to a point over the ash bin, automatically dumped, reversed, returned to the inner end of the trolley hoist and finally lowered to the turntable in the boiler house basement. The entire cycle of operation is effected by hand control of a single starting switch, the control of trolleying, dumping and lowering being entirely automatic, the attendant simply closing the pilot switch. The trolley is capable of hoisting one ton of ashes contained in a bucket weighing about 1,500 lb. at a speed of 60 ft. per minute.

Water Supply System.

Water is taken from two mains of the Montauk Water Co., connected to an 18-in. main, supplying the power house. In order to be sure of having a reserve on this supply, there was built adjacent to the Long Island R. R. yard, at a distance of about 2,700 ft. from the power station, the nearest available site, a standpipe 40 ft. in diameter and 80 ft. high, which is connected into this 18-in. main and under ordinary circumstances kept full. As steam turbines are used, the major part of the boiler supply is derived from the hot wells receiving the discharge from the surface condensers. For each generator unit, two hot wells are provided in the form of steel tanks, about 18 x 18 x 6 ft. in size, into which the water of condensation is pumped. Although each unit has its own pair of hot wells, they may all be connected together. The water in these tanks is kept at a constant level by a supply of the make-up water added automatically through the agency of a pump governor actuated by a float valve in the tank.

The make-up water is taken from the outside supply mains and the pipe connections are so arranged that if desired it may first be used for cooling purposes around the building, whence it passes to the open heater. Otherwise it goes directly from the mains to the open heater, which is 8 ft. in diameter and 15 ft. long, and utilizes exhaust steam from the double-acting auxiliary engines and reciprocating pumps in various parts of the building. It has sufficient capacity to heat feed water for 15,000 h. p. of boilers from 40 to 205° F. It was made purposely large in order to serve the purpose of a purifier rather than a heater. The cylinder oil in the exhaust of the pumps and double-acting engines is extracted by allowing the steam to run at a very low velocity through a comparatively large pipe before reaching the heater, and thence into a 26-in. oil separator.

Boilers, Economizers and Stacks.

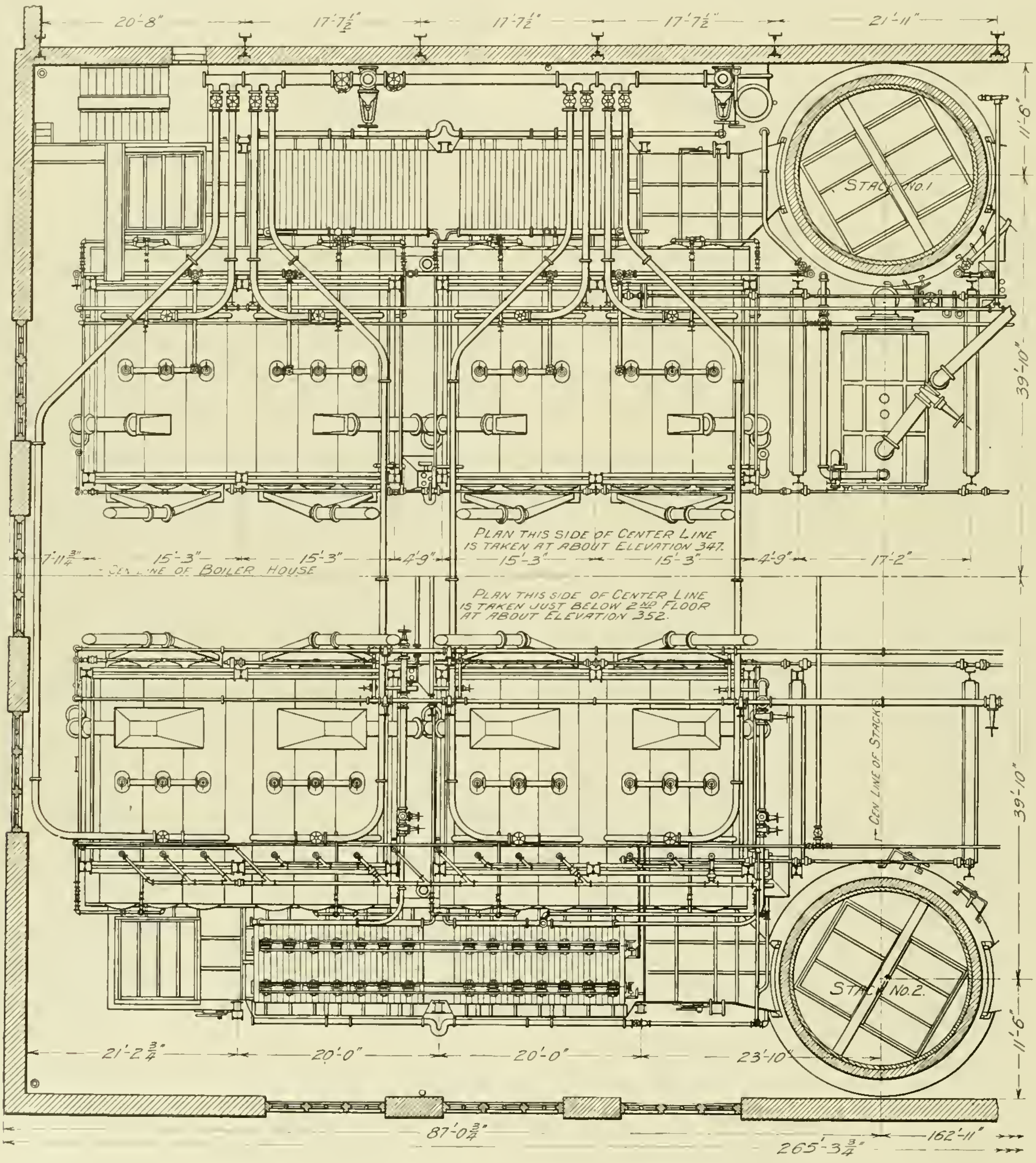
The boiler plant for the station consists of 32 Babcock and Wilcox water-tube boilers set in batteries of two boilers each, eight batteries on the first floor and eight on the second floor immediately over the former; these batteries are equally distributed on each side of the boiler plant, with a firing space between boiler fronts about 18 ft. wide. The boilers are designed for a working pressure of 200 lb. per sq. in. Besides the water-heating surface, each boiler is supplied with an internal superheater capable of superheating the output of the boiler 200° when operating at 200-lb. pressure. Provision is made for flooding the superheater when out of service. Each boiler is fitted with three four-inch safety valves, and has two steam openings, the main nozzle receiving steam from the superheater and the auxiliary nozzle taking its saturated steam directly out of the tops of the boiler drums for use in the auxiliary mains.

Each boiler is fitted with a Roney stoker. The contents of the ash pit are disposed of by gravity down a chute terminating over the narrow-gage railway track in the basement. At the bottom of each chute is a dumping gate for loading the cars provided for the removal of the ashes.

The flues, economizers and dampers are arranged so as to permit the operation of the plant on the unit system, that is, by working each set of eight boilers on one turbine, but at the same time, certain features of interchangeability are incorporated so that the flues and economizers can be interchanged and cross connected to insure the greatest capacity and highest efficiency under all conditions of operation, even though some portions of the boiler and economizer plant may be out of service. One economizer utilizes the waste heat from two batteries of boilers. Under normal conditions, the gases from four boilers discharge into their respective sections of the main flue, then pass through the economizer directly above and into the stack, being under the control of the main damper regulator. In case it is found necessary to isolate any economizer for cleaning and repairs, this can easily be done by closing its inlet and outlet dampers and the gases can then either be by-passed directly into the stack or divided up through the other economizers. All the boilers can discharge through one economizer, or all economizers can be cut out and the stacks may also be cut out so that the number of combinations possible is fully equal to any demands which extraordinary conditions may impose.

The boiler flues are of sheet metal, and are underneath the floor on which the boilers are situated. The economizers are directly behind the boilers, and over the flues. Each economizer consists of 56 sections of 10 tubes each, designed for 250-lb. pressure. The sections are designed with a special system of connections for circulating the water through them. The soot scrapers on the economizer tubes are driven by four small Westinghouse standard engines. The rear wall of the economizer chamber is made of vitrified asbestos air-cell board, laid on in sections, so that in the event of a broken economizer tube it is not necessary to tear down any of the brick work in order to replace the section. The economizers are provided with 6-in. headers, which is a larger size than usual, and each section is provided with a separate blow-off for cleaning. By the use of these economizers, the hot gases are so reduced in temperature that they enter the base of the stack at about 350°.

The four steel stacks are entirely self-supporting and are 275 ft. in height above the base, the inside diameter of the straight portion being 17 ft. 10 in. at the bottom and 16 ft. at the top. They are lined throughout with brick which is supported at intervals of 20 ft. with Z-bar rings riveted around the interior of the stack. Each stack has six openings, two in the basement for the main flues, two for the boiler flues on the first floor and two for those on the second floor. These openings are all heavily reinforced with plates and angles. Each stack is fastened to its base by a segmental cast-iron ring 23 ft. in diameter held down by 20. 3-in. anchor bolts, which pass through a grillage in the bottom of the concrete foundation. In the interior of the stacks are two dampers set in diaphragms for the proper diversion of the flue gases.



FIRST-FLOOR PLAN OF THE BOILER HOUSE SHOWING ARRANGEMENT OF ONE-HALF OF COMPLETED SECTION, INCLUDING THE STACKS.

Steam Turbines and Their Condensers.

For the initial equipment, three main generating units have been installed consisting of steam turbines direct-connected to three-phase, 11,000-volt generators of the revolving-field type. The turbines are of the Westinghouse-Parsons single-flow type, rated to develop 5,500-kw. at 175-lb. steam pressure, and 27½-in. vacuum, running at 750 r. p. m. The length of the turbo-generator unit is 47 ft., width 13 ft. and height 14 ft. to the top of the gallery railing.

The governor which controls the operation of the Westinghouse-Parsons steam turbine consists of a train of levers deriving its motion from worm gearing on the main shaft of the turbine and continuously actuating an oscillating pilot valve, which in turn, actuates the main admission valve (which is of the poppet type) by varying the steam pressure against a piston that lifts it. Steam, therefore, enters the turbine through this main poppet valve, not in a continuous blast, but in puffs, the duration of which is controlled by the amplitude of vibration of the little oscillating pilot valve. The most important parts of the governor mechanism run in oil. The construction of this form of turbine governor lends itself readily to fine adjustment for parallel operation. Directly

under the governor there is suspended a rocker carrying a weight which can be moved along it from one end to the other by a screw forming the extended shaft of a little motor carried on the rocker. This rocker is continually oscillating, receiving its motion through a vertical rod attached to the outer end of the governor lever system. The inertia of the governor leverage system is altered and its amplitude of vibration consequently changed by varying the position of the weight on the rocker through the operation of the little motor. This motor is controlled by a suitable switch gear located in the electrical operating gallery.

The turbine is also fitted with a safety stop which shuts off the steam supply automatically in case the speed exceeds a predetermined limit. A device is also provided for controlling the action of the relief valve in the outboard exhaust connection. Convenient to each turbine there is a stop valve by which the steam supply to each turbine unit can be cut off in the boiler room without leaving the engine room floor. An iron gallery fitted with the usual iron ladders and polished hand rails extends across the tops of the three turbine units. The turbines were built at the East Pittsburg works of the Westinghouse Machine Co.

There is provided for each turbine, a separate condenser of the counter-current surface type, having 20,000 sq. ft. of cooling surface. Each condenser is placed in a large arched opening made in the turbine foundation. There is thus a marked saving in space made possible by the horizontal type of turbine, for it enables the entire condensing plant, consisting of condenser, circulating pump, dry air pump and hot well pump to be compactly grouped within and about the base of the foundation.

The exhaust trunk is of cast iron, rectangular in section, well ribbed on the outside. The outboard exhaust passes over the top of the condenser, through a 36-in. relief valve, to an independent vertical 36-in. exhaust pipe passing up through the roof behind the boilers. The exhaust steam enters the condenser at the bottom. The dry air pump exhausts the vapor from the top and the water of condensation is collected from the bottom by the hot well pump. The circulating water enters the tubes at the top, makes three passes, and is discharged from the bottom of the condenser into the overflow flume directly underneath.

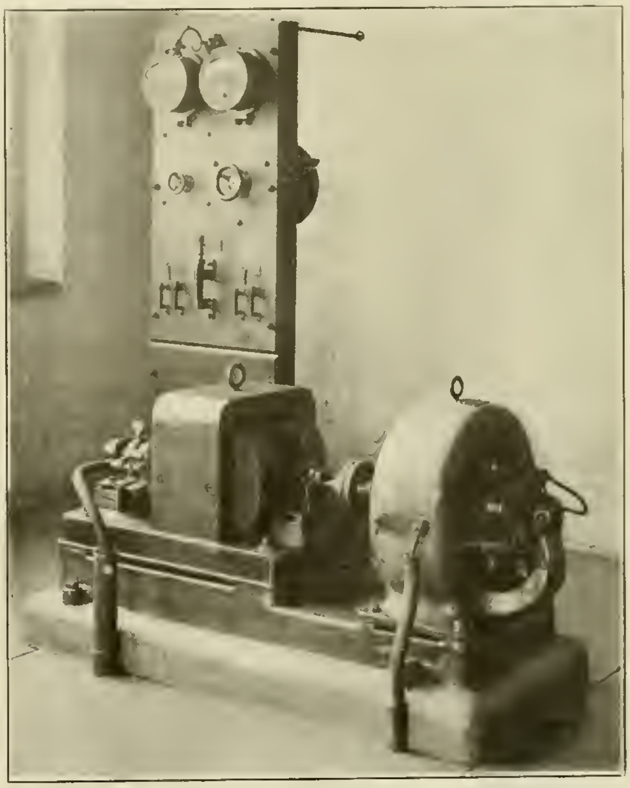
The intake flume is underneath the overflow and access to its contents is made possible by a well extending past the outflow flume down to the intake flume. Condensing water is lifted from this well by a 24-in. double-suction centrifugal pump made by the Morris Machine Works, capable of pumping 20,000 gallons of salt water per minute against a head of 20 ft. Each pump is driven by a 12 x 24 x 12-in. Westinghouse compound engine direct-connected to it. The condensed steam is drawn from the bottom of each condenser and discharged to the hot well tanks in the boiler room basement, by a four-inch centrifugal pump direct connected to a 15-h. p. 220-volt direct-current motor. Vacuum is maintained in each surface condenser by means of a horizontal steam-driven two-stage dry vacuum pump, with corliss valves and automatic governor on the steam end and positive valve motion on the vacuum end. The vacuum cylinders and heads are water jacketed.

Condenser Tube Protection.

A somewhat unusual feature has been introduced to prevent the deterioration usually occurring where salt water is used for circulation in surface condensers. It is the universal experience that more or less galvanic action takes place in any event at the expense of condenser tubes, but this is often aggravated in large plants by the water and the body of the condenser forming a convenient path for stray electric railway return currents getting back to their own power station some distance away through the condenser intake and the water of the harbor. The metallic connections of the power station equipment to the city piping station are through two 14-in. connections to the water mains and on account of the proximity of water mains to the trolley tracks all over the city, there is a tendency for stray currents to flow into the piping of the building and thence to the condenser intake returning through the river to the negative bus-bars of some neighboring power plant. Currents flowing in this manner are certain to cause electrolytic corrosion in the condenser tubes.

The method adopted to prevent this corrosion consists first in providing a shunt circuit between the incoming water pipes and the condenser flume, in order to divert as large a proportion as possible of the current from the condensers. This was done by inserting in each water main connection a short piece of pipe with an insulating joint on each end. These short pieces of pipe were then connected to a 750,000-c. m. cable which was carried to the outer end of the condenser intake. Such current as may leak from the pipes to the water contained in them thus has an opportunity to get back into the harbor without going through the piping system and the condensers.

In order to neutralize the effect of such current as might still leak past the insulating joints, a small booster generator was provided driven by a 220-volt motor, the positive pole of the booster being connected to the heavy grounded shunt cable just mentioned, the negative pole being connected to seven different points on each condenser, there being an adjustable rheostat in each of these branches of the negative circuit. This superimposed voltage can be adjusted by means of the rheostats to exactly counterbalance the natural galvanic electromotive forces due to the brass tubes, the iron shell and the circulating water, together with the stray electromotive forces from outside. With the destructive potentials so counterbalanced, the condenser is in a neutral electric state, which is expected to effectively prevent the corrosion and pitting on condenser tubes and



BOOSTER EQUIPMENT FOR PREVENTING CONDENSER ELECTROLYSIS.

sheets and secure a far longer life than has hitherto been possible for this very important and highly vulnerable section of the steam equipment.

A differential voltmeter is provided which can be plugged to each section of the negative circuit, there being a separate rheostat in each circuit. By adjusting the rheostats for each section it is possible to keep the potential at zero in all of them. The booster apparatus is conveniently situated in the electrical bus gallery directly under the operating gallery.

Piping.

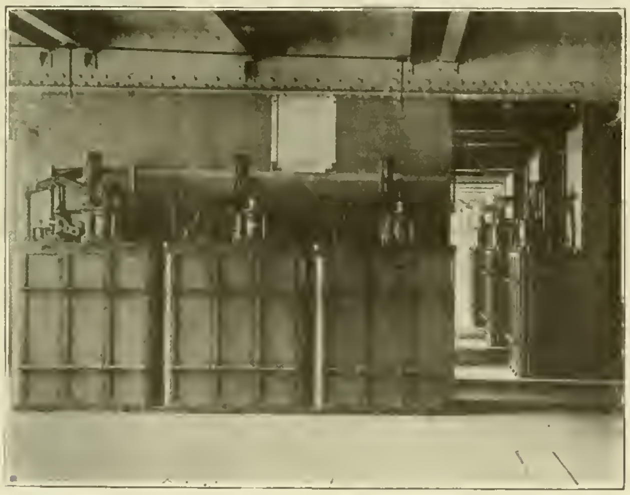
In general, the piping for the main power units in the plant was laid out to conform with the general design of the station on the lines of the unit system and was so arranged that under normal conditions a given group of boilers and auxiliaries serves a single main power unit which is provided with suitable cross and equalizing connections between itself and the similar system of piping of the adjacent power units. The general arrangement of the main steam piping is such that four boilers on each floor, or eight altogether, feed directly to a separate main generating unit, with a cross connection header located back of the first floor boilers, joining these separate feeders and fitted with suitable stop valves.

As it is planned to use steam up to 200 lb. pressure, with 200° superheat, long radius pipe bends were used throughout. Full weight steam pipe with extra heavy welded steel flanges was used throughout on the main steam piping. The fittings are of special design and made of open hearth cast steel. The valves used on this section of the work were specially designed for service under these exacting temperature tests.

The valves are constructed of semi-steel, with integral seats and specially designed stuffing boxes. Gate valves were used except at the boiler nozzles where automatic reverse-current boiler-stop and check valves were provided. The joints were made up with particular care, steel bolts and corrugated copper gaskets being used throughout. The faces of the flanges on the piping, valves and fittings were raised inside of the bolt holes, and the raised faces given a smooth machine finish so as to insure tight joints.

The auxiliary or saturated steam system supplies the steam required for the operation of the reciprocating steam-driven auxiliaries, including the boiler feed pumps, circulating and dry air pumps, stoker engines, together with all reciprocating pumps on the various water and oil systems distributed throughout the station. The boiler connections supplying this auxiliary system, are provided only on the boilers located on the engine room side of the boiler house. This piping is also laid out on the unit system. There is an auxiliary steam line in the basement of the engine room and another in the boiler house basement, and these are so cross connected as to form a loop in much the same way as in the case of the boiler feed piping. Automatic reverse-current boiler-stop and check valves are also provided on boiler connections of this system. All other valves are of the gate pattern. The lines are constructed with heavy weight piping with extra heavy cast iron fittings and flanges, and the joints are made with corrugated copper gaskets. The loop is subdivided into sections by valves so that any section may be cut out without shutting steam off the others.

The main outboard exhaust connection for each turbine leading above the roof of the building, is 36 in. in diameter. This becomes operative through a horizontal relief valve hydraulically operated,



FEEDER GALLERY SHOWING OIL CIRCUIT BREAKERS FOR FEEDERS AND GENERATORS.

the dash pot and operating gear being worked from the engine room floor. The valve and operating mechanism were specially designed to meet the requirements of this plant. In the connection between the turbine and condenser is a copper expansion joint, to prevent strains due to expansion and contraction. There are no cross connections between units in the main exhaust piping system.

The dry air pump connections to condensers are arranged as follows: From each condenser two 6-in. pipes are carried to an 8-in. header located above the dry vacuum pumps, and from this header there is an 8-in. connection to each pump. In each of the branches to pumps and condensers is placed a valve and the headers are also subdivided by valves so that each pump with its section of header may serve a single condenser, or if the header valves are open, it may pump air from any other condenser than that which it normally serves. The discharge from the air pumps is carried into a common header which connects in to the outboard exhaust provided for the two 2500-kw. lighting units, through which it is carried to an exhaust head above the roof. This system is made up of standard weight, wrought iron pipe, and flanged iron fittings, with gate valves of standard design.

The auxiliary exhaust piping is divided primarily into two systems, one receiving the exhaust from the single-acting engines which drive the condenser circulating pumps, and the other receiving the exhaust from all other auxiliary apparatus. The first system leads directly to the closed feed-water heaters in the boiler room basement and has a cross connection to the second system of piping, which system leads directly to the large open heater located on the first boiler room floor, for the purpose of raising the temperature of the make-up water. The auxiliary exhaust piping is made up of standard weight iron pipe and cast iron fittings, with valves of the gate pattern.

The normal feed water supply to the boilers comes from the hotwell or storage tanks which receive their water from the main surface condensers. The water is taken from the tanks by four boiler feed pumps installed in a pump room in the center of the basement. These pumps are of the outside-packed-plunger pressure type, of Epping-Carpenter make, with compound steam ends, steam cylinders 14 and 22 in. in diameter, water cylinder 12 in. in diameter, and 24-in. stroke. In case of emergency the pumps suck directly from the water supply mains. They discharge into a 12-in. pipe running around the ceiling of the pump room, making a loop which carries the discharge to the closed heaters. Each pump can discharge into either side of the loop thus enabling the other side to be temporarily cut out for repairs if necessary.

There are two vertical-coil-pipe feed-water heaters, each containing 1,000 sq. ft. of seamless copper tube heating surface, having 5-16-in. steel shells 60 in. in diameter by 12 ft. long, and designed for 300 lb. working pressure. These heaters are supplied with exhaust steam from the auxiliary Westinghouse engines. The exhaust from the reciprocating pumps at various parts of the basement goes to the open heater earlier mentioned. From the closed heaters the feed water passes through risers to a loop over the first floor boilers, thence to the economizers which have been described in connection with the boilers behind which they are located. From the economizers the feed water passes into another loop above the first floor boilers, whence it is distributed to the individual boilers.

The boiler feed piping in the basement and the risers to the loops above the boilers on the first floor, are constructed of extra heavy cast iron pipe and fittings, the specials being made of semi-steel. All other pipe in this system is made of brass. Gate valves are used throughout on this portion of the piping.

The blow-off piping system includes the blow-offs from the boilers, the economizers and the drips. These connections are joined up to a general waste pipe which discharges into the flume. The blow-off connections themselves are made up extra heavy weight wrought iron with standard weight cast iron fittings.

For returning to the boilers the water of condensation in the steam pipes, two Holly gravity return systems are provided. One of them serves the main or superheated steam piping, and the other the auxiliary steam piping. The receivers of these systems are placed in the engine room basement near the partition wall between the engine and boiler room. Connections from all points of the steam piping where water tends to collect, are carried back to these receivers from which pipes are carried to the discharge chambers which are located on the wall of the house above the second tier of boilers. From this point the returning pipes drop into a return header located above the drums of the first tier of boilers, and connected into them, thus returning the condensation from the pipe into these boilers. This system of piping was constructed of extra heavy wrought iron pipe with extra heavy cast iron fittings and iron body valves.

There is also a system of water piping for general supply purposes. This system is supplied by two compound duplex piston pumps. These pumps are constantly operating against a head of 60 lb. pressure and each has a capacity of 500 gallons per minute. The cooling water after being circulated through the bearings is collected and returned again to the general supply main in the power house. This is done by means of two compound duplex pumps, each having a capacity of 200 gallons per minute.

Another auxiliary water supply system is installed for the purpose

of washing and testing the boilers. This system is served by one 8 x 12 x 7½-in. compound duplex outside-packed pressure type pump able to supply 250 gallons per minute at 150-lb. pressure While normally used for supplying water for boiler washing, it is so built that full steam pressure can be turned into the low-pressure cylinder and the pump then worked under 350-lb. pressure which is used for testing the boilers after washing and repairs.

Although the entire power station structure is absolutely fireproof, it is situated in the middle of a manufacturing district and adjacent to the water front in a position that calls for complete fire protection against outside conflagration. This is effected by an extensive system of cast iron flanged fire pipe line with 11, 1⅜-in. monitor nozzles disposed along the upper walls of the building and the coal conveyor structure. Siamese hose connections are provided at the sidewalk level at the four corners of the building, and one inside the boiler house at the end of the coal bunker. This system is served by two 12 x 10 x 12-in. brass-lined, 1,000-gallon pumps installed in the engine room basement, with salt water suction direct from the intake flume. These pumps are constantly under steam and are pumping against a head of 100 lb.

Oiling System.

There are three systems of distribution of lubricating oil. First of all is that which distributes the oil to the turbine bearings and includes a storage tank situated in the boiler house from which oil is distributed by gravity to the turbine bearings. From the bearings it is carried to a filter tank from which it is pumped automatically to the storage tank. The connections of this system are all of brass pipe. There are about 5,000 gallons of oil in this system and about 90 gallons per minute are circulated through each turbine when in operation. About 20 gallons per day are drawn off for various purposes, this including a very small loss by evaporation.

The oiling system for the crank cases of the Westinghouse engines used for the auxiliaries includes a storage tank which supplies by gravity a system of piping that leads to all reciprocating engines and allows the addition of new oil when needed. The discharge from the engine crank cases is pumped back to the tank and used over as often as desired.

Cylinder oil for the lubrication of the cylinders of the reciprocating engines, is handled by the system which includes a storage tank feeding by gravity through a system of piping that serves the lubricators on all the reciprocating engines and pumps. Fresh oil is raised into this storage tank from small receiving tanks by means of compressed air.

Except in the crank-case oil return line, which is of standard weight wrought iron pipe, all oil piping is of brass with cast iron fittings. All sizes above four inches are fitted with cast iron flanges into which the brass pipe is expanded.

Compressed air supplied by a motor-driven compressor, is used for cleaning the main and auxiliary generators, switchboard apparatus and electrical accessories, and also in connection with the oiling system for forcing new cylinder oil and new crank-case oil into the storage tanks from which these oils are delivered to the oiling system. It is also used for an air hoist for handling oil barrels and emptying them into the receiving tank. The pressure usually carried on the system is 80 lb. per sq. in.

Pipe Covering.

The non-conducting covering applied to the superheated steam pipes consists of a one-inch layer of asbestos cement, over which is a one-inch layer of 85-per cent magnesia blocks in turn covered with three-quarter-inch cement enclosed in a heavy canvas jacket. The saturated steam pipes are covered with a suitable thickness of 85-per cent magnesia jacketed with heavy canvas, as are the boiler feed lines and high-pressure drips and all other auxiliary piping and heaters. The smoke flues are jacketed first by a one-inch air space and then with a one-inch covering of 40-per cent magnesia overlaid with a half-inch coat of hard finishing asbestos cement. The canvas covering on the pipes and other surfaces was given two coats of paint, and a general color scheme was devised for the purpose of indicating at a glance the various systems of piping. The scheme was very carefully worked out and as may be imagined, it has been found of great convenience to the operating force.

Electrical Equipment.

The turbo-generators are each designed to deliver 289 amperes per terminal at 11,000 volts, and 80 to 100-per cent power factor for a period of 24 hours continuously, with a rise in temperature not to exceed 35° C; and a 50 per cent greater current for two hours with a rise not exceeding 55° C.

Three separate sources are provided for exciting the fields of the main generators; two steam-driven exciters, one motor-driven exciter and a storage battery. These are designed to give direct current at from 180 to 220 volts. The steam-driven engine units each consist of a Westinghouse-Parsons steam turbine direct-coupled to a 200-kw. direct-current turbo-generator designed to run at 1,800 r. p. m. These turbines are of the same general type as the main units and are designed to run either condensing or non-condensing. The motor-driven exciter, also of 200-kw. capacity, is driven by a 290-h. p., three-phase, 440-volt induction motor, both motor and generator being mounted on the same shaft, bearings and bedplate. The storage battery is installed in a specially arranged room in the engine room basement and consists of 110 cells each containing seven plates of the type-R "Chloride Accumulator" manufactured by the Electric Storage Battery Co. This battery has a discharge rate of 366 amperes for one hour and is normally kept floating across the excitation bus.

The generators are designed to run in parallel on either of two sets of main bus-bars, called the "working" and the "auxiliary" bus, only one set of which is generally in use.

The switches for the outgoing feeders are arranged in groups of six, the feeders being tapped from an intermediate or "group" bus. In order to distribute current to the feeders it is first necessary to connect a group bus to either the working or the auxiliary bus, and this is done by providing each group with two selector circuit breakers, one for each of the two sets of main bus-bars. Thus any generator or any group of feeders can be connected at will to either set of main bus-bars.

The three bus-bars of the working bus are disposed in the three-story bus structure of brick and alberene stone, the auxiliary bus being placed in a similar structure directly opposite the main bus.

CONTROL BOARDS IN THE OPERATING GALLERY.

Ranged along the inner sides of these bus structures, and facing each other, are two lines of Westinghouse, type-C, oil circuit breakers. The two smaller breakers on either line directly opposite each other are the generator selector circuit breakers, and the two larger ones are the feeder group selector breakers. These successive pairs of feeder selector switches are joined underneath the floor by group bus-bars, and there being a selector switch at each end of this group bus-bar, it can be joined to either the main or auxiliary station bus. The main generator switches are connected to similar sets of cross-connected bus-bars joining the generator selector switches, thus enabling any generator to be thrown in on any set of bus-bars by closing the proper selector switch. The feeders are tapped from the group bus joining to opposite feeder selector switches, six feeders being tapped on to each auxiliary group bus, and each feeder having its separate circuit breaker. The feeder circuit breakers are therefore installed in groups of six. A cross section through the

switchboard galleries at the feeder cubicle is shown and illustrates how the feeder selector circuit breakers, attached to either the main or the auxiliary bus, can connect to either bus, the feeder bus directly underneath to which are attached the feeder switches, from which the outgoing cables are seen descending through the basement to the three-conductor cables entering the conduits.

In the same sectional view may be traced the main generator cables which on leaving the main breakers, run in septums directly under the bus gallery floor with connections reaching up to the generator selector switches by means of which the generator can be thrown at will on either set of bus-bars. The arrangement of circuit breakers, bus-bars and accessories is designed to accommodate all the apparatus that will be installed in the present building, that is half the ultimate station. All of the circuit breakers are Westinghouse, type-C, oil switches, with remote electrical control.

Besides the oil switches there are also installed disconnecting hook-type switches to be opened and closed by hand, for isolating various parts of the system of connections when not in use, or while being inspected. These are mounted on heavy porcelain pillars placed in small compartments built into the brick bus structure. Bus potential transformers are provided, mounted in brick and alberene stone compartments on top of the bus structure.

The buses themselves are composed of copper bars 3 x ¼ in. in section resting on heavy porcelain pillars, each in its own compartment of the bus structure, and entirely isolated from the other two. The main connections between the bus-bars and all the main, generator, selector, and feeder switches are of heavy copper rods carried on porcelain insulators within brick compartments or septums to secure complete isolation of each conductor from all the others. From the feeder circuit breakers on the feeder gallery, the separate cables pass down through the floor, still in brick septums,

BUS-BAR STRUCTURES AND SELECTOR SWITCHES.

to a few feet below the basement floor level, where they are spliced to the conductors of the three-phase cables, which pass into the out-going ducts which are laid in the floor of the basement gallery.

The connections between the main generator switches, the bus-bars and selector switches and feeder circuit breakers, are all of heavy copper bars or rods, mounted upon porcelain pillars. Bars and connectors of opposite polarity are separated by barriers or partitions of alberene stone.

Electrical Control Apparatus.

The system of switches, bus-bars, and regulating or other auxiliary apparatus, is all controlled from the operating room at the east end of the third or operating gallery. This location at the east end of the present engine room will be opposite the center of the completed engine room when the building is extended to accommodate the final installation. This gallery is about thirteen feet above the main engine room floor, and projecting from the generating room is an overhanging observation balcony that gives good view of the whole engine room. Mutual intelligence for the proper operation of the turbines and the controlling switches is commonly interchanged between the engine room floor and the operating gallery by means of a system of visual signals.

The control apparatus consists of the following parts: generator control bench; generator instrument board, directly in front of the bench; feeder control board, exciter switchboard and auxiliary switchboard. The panels are of marble and all panels and the metal fittings, switches and instrument cases have a dead black finish. The bench resembles a low desk with an inclined top, and accommodates three sets of operating handles for the generator main switches and selector switches, one set for each unit, and two sets for bus junction switches, which divide the main bus into sections.

Directly opposite each generator panel on the desk is a vertical panel in the generator instrument board. Beginning at the top, the instruments on this panel are as follows: alternating current voltmeter, alternating current ammeter, indicating wattmeter, power factor meter, direct current ammeter and integrating wattmeter. There is also a synchronizing lamp, and a lamp indicating the position of the field rheostat, besides an illuminating visual indicator forming the return signal from the engine room. These instruments are all operated from current derived from shunt potential transformers and series transformers suitably located in the leads from each machine.

On the narrow panel, at the left of the three generator instrument panels, are mounted three alternating current voltmeters, giving bus potential on each leg of the circuit, and a frequency meter. There are also two synchronizing lamps on this panel, one for each bus. On the bus junction panel at the right hand end of the instrument board, are mounted a differential alternating current voltmeter, two synchroscopes with plug receptacles, two synchronizing lamps and an alternating current ammeter to indicate the current in the grounded neutral bus from the generators.

The feeder switchboard consists of three vertical panels, each containing apparatus for the control of six feeders and two feeder group selector switches, one of the latter running to each bus, and enabling the group of feeders on that panel to be put on either bus at will. Each of the three panels is at present equipped with only three sets of feeder control apparatus.

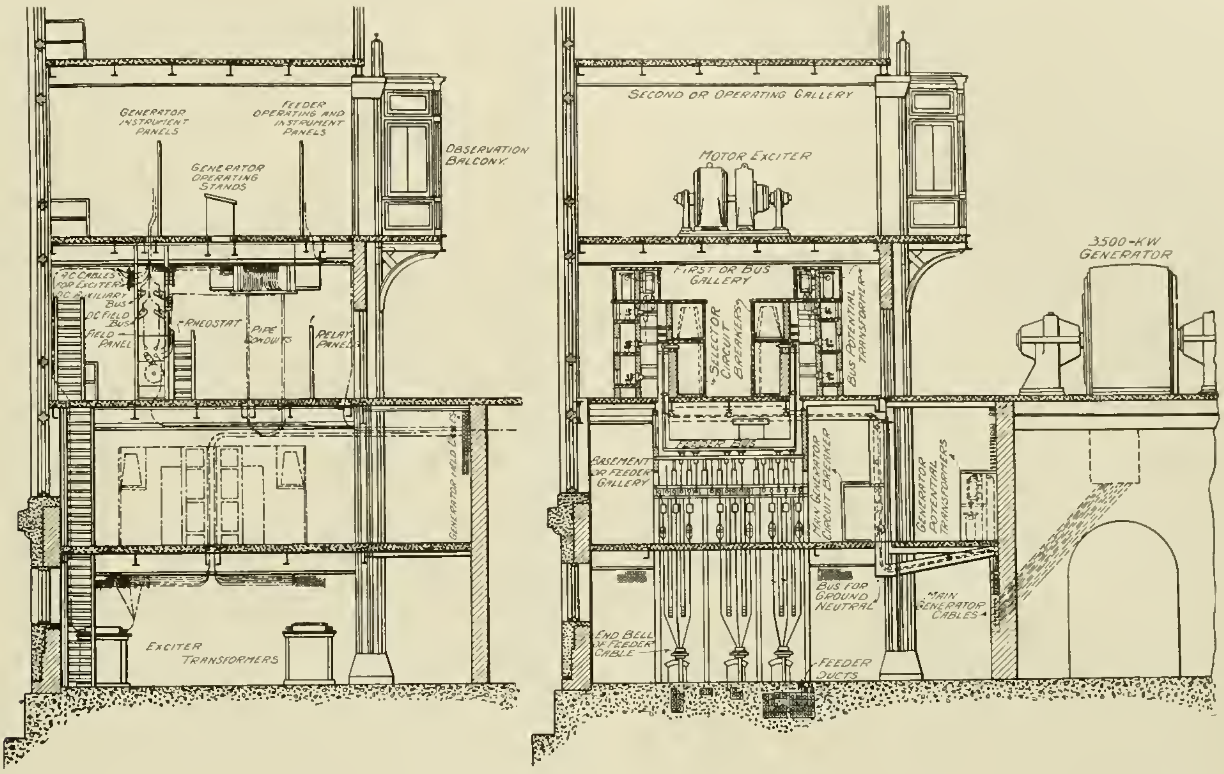
The exciter switchboard is placed to the left of the generator instrument board with several blank panels intervening. It is designed to control the output of two steam exciters, three motor-driven exciters, and the storage battery. It is fitted with two sets of bus-bars, one normally used for generator excitation only, and the other for the station lighting and auxiliary apparatus. The direct-current exciter generator panels are of the usual standard type of panel, but fitted with double-throw switches to supply either the exciting or auxiliary buses. Upon the battery panel are mounted all the necessary switches, rheostats and other devices for controlling the motor-driven booster, whose function is to charge the storage battery. There is also a panel controlling the motor of the electrically driven exciter set.

A separate auxiliary switchboard controls the supply to all the various direct-current motors and the lighting system throughout the station, and from it is also supplied the current required for electrically operating the generator, selector and feeder oil switches. This switchboard consists of four panels.

The feeder circuit breakers are fitted with both automatic and independent hand control. The automatic control consists of an alternating current relay, receiving current from a series transformer connected in the feeder, which relay closes the 220-volt circuit across the opening solenoid on top of the breaker. Independent manual control is effected from the main switchboard by simply closing the 220-volt solenoid circuit by a switch that is in parallel with the automatic alternating current relay. All the outgoing feeder and main generator switches are fitted with both kinds of control, but all the selector switches have manual control only. The indicating lamps for each switch controller are mounted underneath the bench and indicate when lighted through different colored lenses set flush with the top of the bench. Auxiliary contacts on the oil switches light one or the other of the lamps depending on whether the switch is open or closed so that the operator receives a positive return signal when the switch mechanism has completed the intended movement. The lamp indication of course changes and a gong rings when a switch opens automatically from the protecting devices described later. It might also be noted that the generator selector switches are interlocked through the synchronizing plug so that a generator selector switch cannot be closed to either bus un-

less the synchronizing plug is in place and the synchronizing devices record the condition of phase relation.

None of the power house cables either high or low tension is lead-covered. The varnished cambric insulation of the cables which were manufactured by the General Electric Co. is guaranteed to be sufficient for the working pressures adopted without the necessity of sheathing it with a continuous waterproof covering of lead, under the conditions that prevail in this power station, the ducts being



SECTIONAL ELEVATIONS OF ELECTRICAL GALLERIES.

so constructed that there is no possibility of moisture collecting in any point of the duct system. The feeder cables leading to the high-tension transmission system are of the three-conductor type. Each conductor is of 250,000 c. m. cross section and is wrapped with a layer of paper insulation 7-32 in. thick. The three insulating strands when twisted into one cable are then surrounded with an additional insulating wrapping 7-32 in. thick and the interstices filled with jute. The whole is enclosed in lead sheath 9-64 in. thick. After installation, the cables successfully withstood the prescribed test of 30,000 volts applied continuously for a period of four minutes.

The general use of the distant control type of switch for the main power circuits, the auxiliary apparatus and lighting, required the installation of a large amount of control wiring between the switches and the operating board, which was all run in "loricated" iron pipe conduits.

A very complete system of signals for intercommunication between engine man and electrical operator has been installed. Suspended from the large signal board is a load indicator, by means of which the engine room forces are notified regarding the condition and tendency of the station load. This is actuated by an electric circuit manually operated by the main switchboard attendant. Other load indicators of the same type are also located in the upper and lower boiler rooms for the same purpose.

The lighting for the station is effected by means of arc lamps for general illumination and incandescents for detail illumination. The heating of the electrical galleries and offices is accomplished by means of a direct system of low-pressure direct steam pipe coils.

The traveling crane serving the engine room has a capacity of 55 tons, and a span of 64 ft. There are two elevators installed, one of them being a passenger elevator for serving the offices and electrical galleries and the other a combination freight and passenger elevator in the boiler house, running from the basement to the top of the coal bin. These elevators were made by the Marine Engine & Machine Co. and are all of the electrically-controlled type.

A very complete machine tool equipment is provided to facilitate light repairs. The space set apart for this machine shop is on the top floor in the north side of the building directly over the electrical operating gallery. A generous equipment of machinery is arranged in two groups driven by a line shaft which extends over both groups but is subdivided at its center by a clutch coupling. Two 15-h. p., type-C Westinghouse, 400-volt, three-phase induction motors are coupled to the shaft, one at each end.

Organization.

The station was planned and built by Westinghouse Church Kerr & Co., engineers for the Pennsylvania, New York & Long Island Railroad Co., which is the organization through which the Pennsylvania Railroad Co. is carrying on its New York extension work. The design and construction were under the charge of George Gibbs, chief engineer of electric traction of the road and under the general supervision of the Mechanical and Electrical Advisory Committee-New York Extension, a committee composed of officers of the Pennsylvania Railroad Co.

Big Island Park.

Big Island Park is the name the Twin City Rapid Transit Co. has selected out of over 2,000 names suggested, for its new amusement park on Big Island at Lake Minnetonka. In response to the company's invitation for suggestions of a name, replies came from all over the United States. All classes of persons took part in the contest and many suggestions came by wire.

The name selected commends itself because it is historic, the island having been known as Big Island for 25 years or more. It also conveys the meaning of an island park which is exactly what the new amusement resort will be. The keen interest manifested, indicates how the Twin City's new amusement island at the lake has aroused the public, and with all the suggestions came pleasant words of good luck and well wishing for the island.

The use of a vacuum process for cleaning the subway in New York was given a demonstration recently at the Worth St. station of the Interborough system. The apparatus consisted of a small horse power engine and a plant ordinarily used for cleaning carpets. It proved highly successful and removed the greasy dirt from the girders as well as the dust on the tiling and woodwork.

March Meeting of the Central Electric Railway Association.

The March meeting of the Central Electric Railway Association was held at the Claypool Hotel in Indianapolis on March 22nd. The attendance was large and promised well for the future success of the association. The morning session was called to order at 11 o'clock by President E. C. Spring and the regular order of business followed.

President Spring announced that the association has established its secretary's office in the Traction Terminal Building at Indianapolis and extended an invitation to all electric railway men to make this office their headquarters whenever visiting Indianapolis. The supply men especially were informed that the headquarters of the secretary is the central bureau of information and that they are welcome there and should feel free to have their mail or telegrams sent in care of the secretary. The secretary, Mr. J. H. Merrill, is now located in this office permanently with a corps of assistants and has already done considerable creditable work, having sent out over 15,000 circulars. The information sent out from this office to the various companies has been much appreciated by them.

The president announced that, owing to an unavoidable delay, the constitution and by-laws of the new association were not ready for distribution, but that they would be mailed in a short time. He announced that the next meeting of the association would be held on May 24th at Columbus, O. President Spring announced that similar letters had been sent to every company in Ohio and Indiana, asking for contributions of $50 each to support the secretary's office. Such an amount should be considered small, on account of the general publicity which will be given to all of the companies by the secretary's office. Arrangements were being completed for the publication of a "Way-Finder" designed for the purpose of furnishing to the patrons of the various roads in Ohio and Indiana information as to the points now reached by the lines, the rates of fare, mileage and the time of arrival and departure of all trains. The support and aid of all the member companies was earnestly solicited in this work and it was hoped that they would promptly respond to any requests for information from the secretary and offer to him any suggestions which might occur to them pertaining to each of the individual lines. In regard to the membership fees, attention was called to the fact that many of them were still unpaid by companies in both states. The work of the treasurer of the old Ohio association has been completed and when the accounts are turned over to Mr. Merrill, there will be a balance in favor of the new association.

The following committees for the ensuing year were then announced: Committee on Subjects and Arrangements to be composed of the president, secretary and treasurer of the association; the Committee on Transportation to be composed of J. H. Merrill, chairman, F. W. Coen, D. J. Edwards, F. W. Adams and F. D. Norveil; the Committee on Publicity to be composed of George S. Davis, E. B. Grimes and J. R. Harrigan; the Committee on Insurance to be composed of H. J. Davies, C. L. Henry and F. J. J. Sloat. There will be no legislative committee appointed.

President Spring then introduced E. J. Burke, president of the Blake Signal Manufacturing Co., Boston, Mass., who presented a very interesting paper on the operation and uses of the Blake signals. This signal was illustrated and described in detail in "The Street Railway Review" for December, 1905, to which article we are pleased to refer our readers. Mr. Burke had a working set of signals set up in a room on the ground floor of the hotel, which was visited in the course of the day by the majority of the members. An abstract of Mr. Burke's paper follows:

Blake Signals: Their Operation and Uses.

BY E. J. BURKE.

Blake signals are practically visual telephone signals, and their use removes the one sided feature of railway line telephone systems as at present installed. These signals complete the calling system so that the telephones can be used to their full advantage by both dispatcher and car crews in the routine of their usual duties.

The relative necessity for communicating with crews cannot be measured by the track mileage, for the reason that for a given number of miles of track, the electric road will operate at least three or four times as many train units as the steam roads under ordinary conditions, while on special days and holidays the electric road traffic will increase in a much greater proportion. In winter, when the snow plows must be sent over the line, the need for this power of communication is largely increased on electric roads.

Realizing these facts, the management of many electric roads installed telephones at certain points, thus solving the problem so far as allowing the car crews to communicate with the dispatcher, but leaving unsolved the more important matter of permitting the dispatcher to selectively communicate with the car crew. To overcome this one-sided method of communication, orders were given that at certain points, all car crews should stop and call up the dispatcher. It is almost needless to call attention to the amount of time wasted by both crews and the dispatcher, as well as the halting and antiquated methods of operation that must necessarily result from all crews calling up from fixed points, whether they are wanted or not, and the attendant discomfort and loss of time to patrons. The dispatcher is kept busy answering such calls, is thus distracted from more important duties, and is more liable to eventually make a mistake with the usual disastrous consequences. If at certain meeting points a crew must lose a minute or two in calling up the dispatcher, it will not take many such stops to put the crew behind time. Also with this method, the running time must be lengthened, and on long runs, instead of getting four or five trips out of a crew and car, only three or four can be made in a day's work. The loss of a trip by any car crew means the loss of the money which that car and crew would have earned on that trip. It is certainly the legitimate object of any railroad management to get the maximum earnings from a minimum of operation cost, consistent with the comfort and safety of its patrons; and any apparatus which will aid in this attempt, certainly has a positive value, both to the railroad company and the people whom it serves.

A dispatcher's signal eliminates all unnecessary loss of time, establishing a ready and certain means of communication between dispatcher and crews. In addition to this feature, a reliable dispatcher's signal increases the safety of operation in the following ways: All roads have certain meeting points where cars ordinarily pass, and the car crews become accustomed to stopping at these points and running by other sidings and turnouts. Now, if for any reason the dispatcher must give orders for crews to pass at unusual points, he can, by setting a semaphore and showing a red light, insure against the car crew forgetting to stop at this unusual meeting place. Furthermore, many accidents would undoubtedly be avoided by a dispatcher being able to set a signal and stop, or give caution orders to a car crew at any telephone point on the line.

The telephone has reached a state of perfection that makes it as safe and reliable as any human agency can be, while its use has become so general that everyone is accustomed to it and can use it with facility. Thus, the telephone becomes an ideal, cheap method of communication; no specially trained and schooled operator being needed to handle it. The one thing needed in combination with the telephone is a signal, simple in mechanism, positive in action, and reliable in service, that can be operated by the dispatcher so as to call to a telephone at any desired point, and at that point only, any one of the crews on the line. This is a need that the Blake signal was designed to meet, and that the solution has been eminently satisfactory is proved by the successful operation of this signal, in various parts of the country, during winters of exceptional severity, involving the severe tests of extreme cold and quantities of snow, ice, sleet, etc., as well as through summers of heavy traffic and the usual electrical disturbances.

The Blake signal is not an automatic signal in the usual accept-

ance of the term, and does not and never was intended, to cover the field of automatic signals. It is intended for use in connection with the telephone system, and the purpose of the signal is to allow the dispatcher to selectively signal to any point on the line, when he wishes to communicate with the passing crews. The Blake signal, in other words, gives the train dispatcher the same command of car crews that the steam road train dispatcher enjoys by using telegraph lines with stations at certain intervals, where the operators can be instructed to signal the train for special orders. The operation is simplified in that instead of communicating with a telegraph operator, giving orders and having the operator set a signal and repeat the orders to train crews, the dispatcher sets a signal and gives the orders to the train crew direct by telephone on its arrival at a certain station.

The mechanism of the Blake signal is entirely independent of the telephone, and where telephones are already installed, the signal may be put up as an adjunct.

I have gone at some length into this discussion of the uses of the signal, in order that it may not be confounded in any way with automatic block signals.

The signals on exhibition are exactly the same, in every detail, as some which we have been operating since July 1, 1905, on the line of the Illinois Central Traction Co., between Springfield and Decatur, Ill. The apparatus consists of a dispatcher's office equipment and line semaphore signals, each signal containing an electromagnet and pendulum. These signal pendulums vary in length, and each one corresponds in length to one of the pendulums in the dispatcher's office. The dispatcher's office equipment consists of a desk-like box containing 15 pendulums of different lengths and platinum contacts, which are made and broken by the swing of the pendulums at intervals varying with the length of the pendulums, capable of transmitting impulses over the line (consisting of a single, bare, iron wire) which impulses are synchronous with that dispatcher's office pendulum which happens to be vibrating, and influence only that signal on the line which the dispatcher desires to operate.

The basic principle of the signals is that the time of vibration of a pendulum varies with its length. Therefore, if we, at some central point, such as a dispatcher's office, start in vibration a pendulum of a certain length, allowing it, as it vibrates, to open and close an electric circuit, electric impulses will be set up in that circuit, synchronous with the vibrating pendulum. These impulses energize the electro-magnets of all the signals on the circuit, and start vibrations in all of the signal pendulums. On only one signal, however, namely that one whose pendulum is of the same length and therefore synchronous with the pendulum vibrating in the dispatcher's office, will these electro-magnetic impulses be of a proper period to be cumulative in effect, and swing the pendulum in an ever-increasing arc of vibration. On all the other signals, the impulses being out of beat, the pendulums will receive a check before they have swung through any considerable arc. On the signal which it is desired to set and on the pendulum of which these synchronous impulses are accumulating energy, the pendulum having reached a certain arc of vibration, mechanically trips a lock, releasing a semaphore arm three feet long, which falls to the horizontal position by gravity. Having reached a horizontal position, this semaphore closes the local signal lamp circuit and also interruptedly closes a shunt to ground on the signal line, causing a sounder to draw up in the dispatcher's office and notify him of the fact that the signal has operated.

For instance, when the dispatcher wishes to set signal No. 9 he inserts a plug, similar to a telephone plug, in hole No. 9. This releases pendulum No. 9, and also connects the line with the 500-volt circuit which is brought to the dispatcher's desk. As the pendulum swings it opens and closes the signal line circuit, sending impulses over the line synchronous with its vibration. At the end of 13 seconds this line signal pendulum swings through an arc wide enough to trip a lock and drop the semaphore arm. The car arrives at the station and the motorman or conductor calls the dispatcher by telephone, saying, "Brown and Hayes at No. 9 for orders." The dispatcher then transmits his orders to the conductor or motorman. The conductor or motorman, if so instructed by the dispatcher, then pulls a cord which sets the semaphore at "clear" position ready for future operation.

When properly set up and adjusted, it is physically impossible for any other signal than the one desired to operate. There is a positive indication to the dispatcher, showing that the semaphore arm has been set in the horizontal position, and that until the arm has reached an angle of about 45 degrees it is a physical impossibility for the dispatcher to get this indication and the danger of a false indication is eliminated. The power for operating the signals is obtained entirely through the dispatcher's office, and there is no local circuit at each signal, other than the signal lamp circuit. There are no electrical contacts in series with the operating magnets at the various signals. The signal line is electrically continuous throughout, from the dispatcher's office to the return circuit at the end of the line. If one signal lamp burns out, a second lamp is automatically cut in circuit. This second lamp is in an interrupted circuit and gives a flashing light, so that any crew can report the burn-out and a new lamp can be put in the following day. This detail removes the necessity of having a daily inspection of all lamps, as well as danger from a new lamp being defective and burning out a very short while after it has been put in. The widely varying voltage of trolley lines is taken care of by relays which draw up at different voltages, and cut in or cut out resistance as the voltage which is supplied at the dispatcher's office rises or falls. The apparatus is able to take care of voltage variations between 300 and 700 volts. The line consists of a single No. 10 bare galvanized iron wire supported on glass insulators.

In the discussion which followed the reading of the paper, Mr. Burke was asked as to the length of the line over which the signal could be operated. He replied that the signal had been in effective operation over a distance of 40 miles. He also stated that the line had withstood a breakdown test of 2,500 volts. In response to a question from Mr. Henry regarding protection from lightning, Mr. Burke replied that the system was not entirely free from lightning trouble, but that so far no complaints had been received by the company. It was asked how it could be ascertained whether or not any particular signal was in working order. The reply was made that in case of injury to a signal, the dispatcher would be at once aware of the fact, since he would receive no indication from the sounder in his office. When questioned as to what means was taken in the design of the apparatus to make certain that the signals operated by the different pendulums would fall in the same period of time, Mr. Burke replied that this was secured by regulating the weights of the pendulum bobs, making the weights of the shorter pendulums heavier than those pendulums of a longer length.

At the close of the discussion on Mr. Burke's paper, President Spring announced that the chair had decided upon an arrangement to better stimulate the interest and get at the needs and requirements of the member companies in all the different localities in the various states. To that end it had been decided to appoint local committees in every large city throughout Ohio and Indiana. These committees would confer directly with the secretary of the association and would keep in close touch with its workings. Since the meetings were to be held but once in every two months, something of this nature was needed to keep up the interest. He announced that the principal feature of the meeting in Columbus would be the consideration and discussion of a number of small matters which were being constantly brought to his attention. One company had written him that it has considerable trouble from people who refused to pay half-fares for children. It was the treatment of questions of this nature that would be considered. Members were requested to forward to the secretary any matters which they wished to have taken up. The meeting adjourned at 11:45 a. m.

The afternoon session was called to order by President Spring at 2 o'clock. In introducing Mr. S. B. Hutchins of the Westinghouse Air Brake Co., President Spring expressed his thanks to the Westinghouse company for the elaborate working model of its air-brake equipment which the company had installed in the assembly hall. By way of introduction to the paper entitled "Advancements and Improvements in Air Brakes," by W. V. Turner, chief mechanical engineer for the Westinghouse company, Mr. Hutchins read a very interesting paper dealing with the early history and later developments of the Westinghouse air brakes. Mr. Hutchins' paper is herewith presented:

Mr. President and members of the Central Electric Railway Association:

Permit me as the representative of the Westinghouse Air Brake Co. to thank you for the opportunity of bringing to your attention on this occasion, some of the recent advancements in the air-brake art.

It may seem like a broad assertion but the developments and advancements in the direction of heavier equipment, higher speed and quick service, on both steam and electrically operated railways are restricted to the capacity of the power brakes to destroy the energy and overcome the inertia of a moving train. Every advancement or development in the motive power or other conditions making for higher speed is, in a measure, a menace to the traveling public, unless the factor of safety is increased in the same proportion.

One of the most important problems to be considered, in this connection is the distance in which the car or train may be brought to a stop in case of an emergency. The term emergency being defined as an occurrence, necessitating a quick stop to prevent an accident. In our 30 years' experience in the development and manufacture of air brakes for steam road service, this point has been considered paramount, all other conditions of flexibility, etc., in operation being considered points of refinement. We, however, point with considerable pride to the remarkable achievements in this direction, by which it is now possible to bring to a stop a modern high-speed passenger train, representing a total weight of approximately 700,000 lb., from a speed of 60 miles per hour, in less than 1,000 ft. Moreover this is brought about with all the advantages of refined operation necessary for service embodied in an absolutely reliable and simple apparatus, not only interchangeable as to parts, but also as regards train operation on every steam railroad in North America. Every detail of the operation conforms fully to the high standard of requirements set by the Master Car Builders' Association.

No doubt many of you are more or less familiar with the period of transition from the time the straight-air brake was condemned and its use prohibited on two or more cars in train, to the present perfection of automatic brake operation. I wish to say, however, that very few have any idea of the perplexing engineering problems and the expensive experimental work incurred in bringing the quick-action automatic brake up to its present stage of perfection. One of the valuable assets acquired in this undertaking is the development of an engineering department which, fortified by upwards of 15 years of observation and research, with unlimited facilities for experiments, is fully prepared to meet every exigency of the air-brake situation.

About five years ago we were called on by an interuban construction company in Michigan to furnish automatic air brakes for electrically-driven cars and 10 interurban cars were equipped with our standard steam railroad quick-action automatic brake with a rotary motor-driven compressor. This was one of our first attempts to furnish brake equipment for electric cars. We soon found out, however, that we had made a mistake. The frequent complaints of undesired quick action, rough handling of the car in making stops, slow release and reduced efficiency of brake power in emergency, immediately following a release, etc., resulted in our removing the quick-action, automatic and substituting the straight-air type of brakes.

I assure you that the lesson was not lost. Every objective point was noted in detail before the automatic apparatus was removed from these cars, and experiments carefully conducted to overcome the objections to all features. These were, in a large measure, overcome by the use of combined automatic and straight-air brake equipment, in which the straight-air brake could be used on the car while it was being operated as a single unit, and the automatic feature used when the car was being operated in multiple unit. In the meantime we continued to furnish straight-air brakes on such orders as came to us unsolicited, until about a year later when our traction brake department was formed to actively engage in furnishing air brakes for electrically operated railway cars.

Our principal standards at this time were of the straight-air type, but as we had anticipated, it soon became apparent that the straight-air schedule would not serve for the proper handling of cars in train. Several very disastrous accidents occurred where it was attempted on account of the cars parting while in transit, and the wisdom of the official action of the Master Car Builders' Association in condemning the use of straight-air brakes for train service was in these cases forcibly demonstrated. The growing tendency of electric roads toward the operation of cars in trains further agitated the question of automatic brakes, which will of necessity have to be used.

Our efforts were conducted in the direction of working out a suitable automatic schedule fully covering the requirements of interurban train service. The working out of this schedule, which not only provides for the highest degree of refinement in operation by reason of the quick service, quick recharge, graduated release and graduated application features but also insures absolute safety against the liability of accidents incident to the operation of straight-air brakes on two or more cars in train, has resulted in the development of an automatic brake schedule which is a model of perfection in every particular.

We have been pleased to take advantage of this occasion not only to present to you here today the climax of our achievement in this connection by erecting what is probably the most elaborate exhibit ever installed outside of a national convention, but by also having present Mr. W. V. Turner, chief mechanical engineer of the Westinghouse Air Brake Co., who is not only responsible for the production of this equipment but whose ingenious mind has conceived other remarkable advancements in the air-brake art. One of the great pleasures of Mr. Turner's life is to demonstrate and disseminate the details of air-brake construction and operation which he has so ably mastered and I trust that all herein assembled will feel perfectly free to ask such questions as will tend to clear up any point pertaining to air-brake operation as may not seem entirely clear to them. In doing this we will feel that you are assisting us in our campaign of education and with the permission of our worthy chairman I take pleasure in introducing to you, Mr. Turner.

Advancement and Improvements in Air-Brakes.

BY WALTER V. TURNER.

It is going to be my effort to show you that the air-brake has kept pace with the greatest development of locomotion. In other words, that we are still able to control and stop a train in about the same distance today, where it runs at almost 80 m. p. h. in many instances, and certainly quite frequently 60 m. p. h., and that we are able to stop it in approximately the same distance that we did when the maximum speed was about 30 m. p. h. and the weight of the train less than one-fourth of what it is today.

(In leading up to his description of the equipment of today, Mr. Turner described and illustrated electric cars and their braking equipments, from the early crude forms of push cars to the modern rolling-stock of the Chicago, New York and Boston elevated systems.—Ed.)

The straight-air equipment consists of a motor-driven compressor, reservoir, brake cylinder and brake valves, and the operation is exceedingly simple. After the compressor has supplied the reservoir with air pressure, connection is made through the brake valve down through the brake pipe and into the brake cylinder; and when it is desired to release the brake, the handle is moved to the release position, the air passing from the brake cylinder to the atmosphere. At this time the port is closed from the reservoir to the pipe which conducts the air to the brake cylinder. This is the simplest form of car brake, and I wish to state that as far as flexibility is concerned, and by the word flexibility I mean the ability to manipulate the brake in any possible way that the motorman may desire, it is, as far as one vehicle is concerned, almost a perfect brake. Still it possesses even on a single vehicle one very weak feature, and that is that the air supply has to come from the main reservoir down through a pipe and back up through the brake valve, making two square turns, down through the pipe again making another turn up and into the brake cylinder, and each square turn represents about 30 ft. of pipe; so it has to travel quite a distance before it is able to get to the brake cylinder, and therefore at high speeds a comparatively great distance will be traveled by that car before it is possible to obtain the maximum pressure in the brake cylinder.

One of the features of the automatic brake in which it differs particularly from straight air is that a movement of the brake

valve handle "short circuits" the air directly from the reservoir to the brake cylinder, without any reducing valve and brings about a very quick application of the brake. At 60 m. p. h. the speed is 88 ft. per second; thus it is easily seen that every fraction of a second gained is, in an emergency, of prime importance.

The straight-air storage system possesses one weak feature, and that is that the governor necessarily being set with a range, sometimes 10 lb. and sometimes more, the motorman is braking with a constantly varying pressure, sometimes 20 per cent difference in the braking power that he is able to obtain. Another weak feature is that he has no reserve. There is another system which overcomes that difficulty by placing a reducing valve between the main reservoir and the brake valve.

The Manhattan elevated in New York is equipped with the so-called AMP schedule, which is the ordinary automatic brake adapted to suit the conditions of electric railway operation. This brake is absolutely safe, so far as the braking power is concerned; in other words, if the cars should separate or the brake pipe pressure should be reduced by any means, the brakes will apply. If anything happens to your brake pipe with straight air, it means a loss of the brake. There have been very few accidents on the New York elevated since this brake was used, and they have occurred chiefly from the motorman depleting his auxiliary reservoir. The weakness for traction service of this brake is that the recharge of the brakes is slow, as it takes about 30 seconds to replenish the auxiliary reservoir after it has been depleted 20 lb. by an application of the brakes. When a man must make an accurate stop he is compelled to apply the brake gradually. If you will allow me to say so, railroad people spend thousands of dollars to gain a few seconds in acceleration. They can gain the same amount for a fraction of this sum in deceleration, by proper braking apparatus and instruction of motormen.

A brief explanation of the AMP piping layout may not be out of order. There is the compressor as before and the two main reservoirs, the object of the two main reservoirs being to so cool the air that all the moisture that might be in the air will be condensed, or rather precipitated into the reservoirs before getting into the system. The straight-air pipe is only charged with air when the brake is applied.

With the automatic system the pipe is charged when the brakes are off. The pressure is reduced to apply the brakes and the pipe may be entirely depleted. This, of course, is true when the hose bursts or when the motorman makes an emergency application. Ordinarily the pressure is carried on in the automatic pipe and passes through this pipe, through the triple valve into the auxiliary reservoir. The reservoir also becomes charged so that each vehicle carries the air supply necessary for applying the brakes on itself, the storage carried in the main reservoir having absolutely nothing to do with the application of the brakes.

The air for the operating of the system is supplied from the auxiliary reservoirs, but when the brakes are applied it is not used at all, but only for releasing the brakes and recharging the reservoir. Having passed over the piston and into the reservoir, until the pressure on both sides of the piston is the same, it is plain that any reduction of pressure, no matter how made on the brake pipe side of the piston, permits the pressure that is bottled up in the reservoir to force the piston to application position. This connects the reservoir with the brake cylinder through a slide valve carried by the piston and short circuits the air into the brake cylinder, thus bringing about quick and powerful operation of the brakes. When it is desired to release the brake, the motorman places the brake valve handle in release position and the air flows from the main reservoir to the brake pipe until the pressure in the brake pipe overcomes that remaining in the auxiliary reservoir or on the auxiliary reservoir side of the piston. Then the piston is forced to release position carrying the slide valve with it and opening the brake cylinder to the atmosphere. This allows the brake to release and at the same time opens communication again between the brake pipe and the auxiliary reservoir, recharging the latter.

The rule governing the action of automatic brakes is that any reduction of the brake pipe pressure will apply the brake; any increase in the brake pipe pressure above the pressure in the auxiliary reservoir when the brake is applied, releases the brakes, or any reduction in the auxiliary reservoir will release the brake when the pressure in the auxiliary reservoir is reduced below that remaining in the train pipe. These features have to do only with the applying and releasing. The application can be graduated by alternately moving the brake valve handle to service and then to lap positions, but there can be no graduation of the release when the handle is moved to release position. The re-charging of the auxiliary reservoir is slow for the reason that there is a very small feed groove, necessarily so because you must prevent the back flow of the auxiliary to the brake pipe, because if you did not, when the brake pipe pressure was reduced the auxiliary pressure would reduce with it and there would be no application of the brake. In the improvements all such features are retained, but added to them is what is called the quick-service feature, giving a quicker application of the brake, a graduated release and a quick re-charge; in fact, the re-charge of the reservoir is such that for every pound released from the brake cylinder, its equivalent is put back into the auxiliary reservoir, so that the motorman can make any number of applications of the brake and releases one after another, without any increase in the braking power as long as the compressor is able to keep up the air supply.

The cars in Pittsburg are equipped with the SME schedule, a cross between straight air and automatic. It is a system which requires two hose connections between the cars, one being an automatic or emergency brake pipe and another a straight-air brake pipe. However, it is handled by the same brake valve, and it is possible for a man to get an application of the brake in emergency from the brake valve automatically, that is, he can throw to the emergency position just as he would with the automatic brake valve and obtain an application of the brake, but in all service positions the brake is applied and released by straight air. It makes a very flexible equipment and is suitable for one or two cars.

Motor and trailer cars on the surface lines of Boston are equipped with the AMS schedule. It is a purely automatic brake with no straight-air features unless we say it means straight-air

(Mr. Turner's address continued on page 232.)

A party of 33 members of the Central Electric Railway Association, including the officers of the interurban systems in northwestern Ohio and northeastern Indiana, were privileged, as the guests of Mr. C. D. Emmons, to make a large portion of their trip in one of the magnificent new parlor cars which the Ft. Wayne & Wabash Valley Traction Co. is now operating in connection with the Indiana Union Traction Co., between Ft. Wayne and Indianapolis.

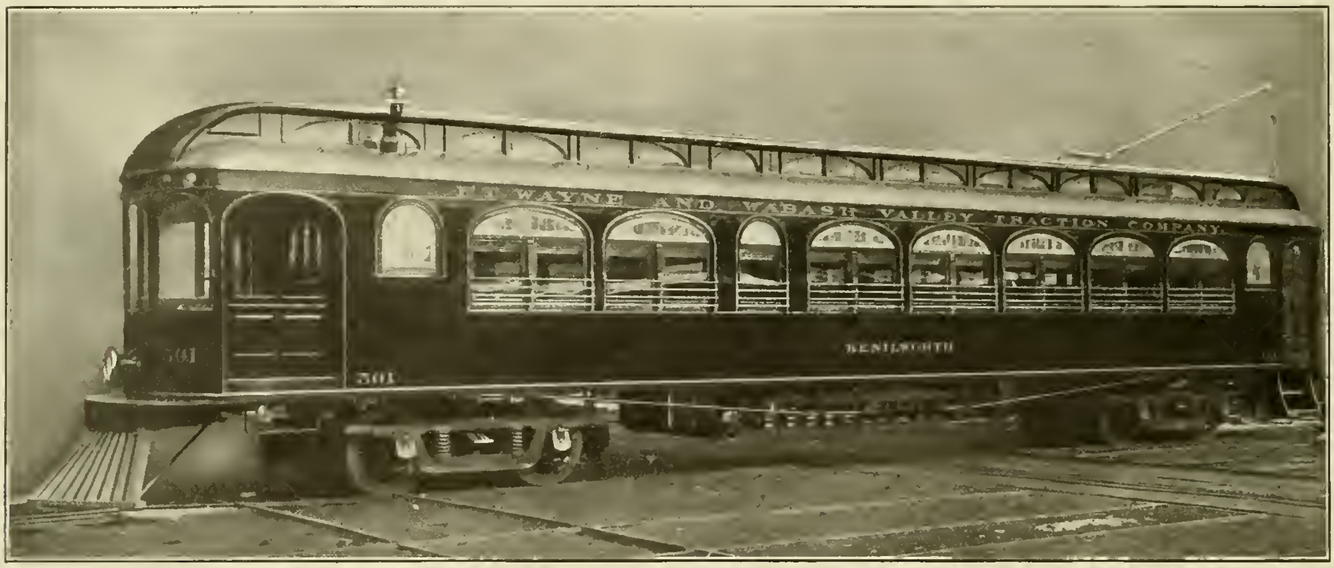
Among those in the party were, Messrs. Emmons, Fordemark, Shelton, Jacques, Weber, Kehoe, Fahlsing, Mollesten and Wilson of the Ft. Wayne and Wabash Valley Traction Co.; Baldwin and Snell, Indiana Union Traction Co.; Carpenter, Wilcoxon, Price, Baxter and Collins, Western Ohio Railway Co.; F. W. Adams, Toledo, Fostoria & Findlay Railway Co.; W. H. Fledderjohann, Ft. Wayne & Springfield Railway Co.; C. F. Smith, W. L. Smith and F. Dudley, Toledo Urban & Interurban Railway Co.; C. C. Wood, Angola Railway & Power Co.; J. A. Barry, Wabash & Northern Traction Co.; H. F. Dicke, Ft. Wayne, Van Wert & Lima Traction Co.; F. A. Bundy, Lima Electric Railway & Light Co., and the following city officials: J. F. France, H. H. Wagoner, Huntington, Ind.; H. L. Hall, Peru; F. Hilty, Wabash, and F. Randall, Ft. Wayne. The running of the car was in charge of Conductor Detrick and Motorman Smith of the Ft. Wayne route and Pilot McNairy of the Indiana Union Traction Co.

A very satisfactory attempt was made to follow the schedule which has since been adopted for the limited service between Ft. Wayne and Indianapolis. Leaving Ft. Wayne at 6:00 a. m., the car reached Peru at 8 o'clock, having covered 59 miles in two hours, including several stops to pick up guests. The remainder of the run was over tracks of the Indiana Union Traction Co., for which an allowance of two and a half hours was made. The total distance of 138 miles was thus run in four and a half hours, reaching Indianapolis at 10:30 a. m., which was according to the schedule adopted and since put in operation.

One of the new cars which will be run in the limited service is illustrated herewith. This type of car has been designed to offer the same comforts and luxuries as are now to be had on

the limited trains of the steam railway trunk lines. The new cars, of which there are nine, are 62 ft. long over all, and were built by the Cincinnati Car Co. The interior finish is very similar to the Pullman style.

The interior of the car is divided into a general passenger compartment to the rear of which is an observation platform nine feet long. As the car is operated single-ended the only entrance for chairs are upholstered in dark leather. The forward compartment of the car is designed to carry baggage and has two sliding side doors. A permanent stool is provided for the motorman and he is protected from the baggage by a substantial framework of pipe. In this compartment are placed the hot water heater, a Babcock extinguisher, emergency tools and the telephone instrument as used on the lines over which these cars will operate.



ONE OF NINE NEW PARLOR CARS FOR LIMITED SERVICE BETWEEN FT. WAYNE AND INDIANAPOLIS.

passengers is by side doors placed at the rear of the car and opening onto the observation platform. This platform is enclosed by heavy plate glass which is curved to the oval shape of the rear end of the car framing. The floor of the observation platform is covered with interlocking rubber tile and camp chairs are provided so that the passengers may enjoy an unobstructed view. Corner settees upholstered in leather have been furnished for this end of the car.

The large passenger compartment is provided with high-back

The woodwork of the interior of the new cars is especially fine, as may be seen from the accompanying interior views. The cars are lighted by clusters of lamps enclosed in inverted "holophane" bowls. A toilet room is provided in the rear of the main passenger compartment with a drinking water tank recessed in its partition wall. The cars are equipped with Westinghouse No. 85 and No. 121 motors mounted on Baldwin M. C. B. heavy trucks. Multiple-unit control is provided for operation in trains of two or more cars. The cars weigh 45 tons each and ride very steadily.

INTERIOR VIEWS OF THE NEW FT. WAYNE & WABASH VALLEY TRACTION CO. LIMITED CAR.

seats upholstered in figured plush and there are also similarly upholstered lounges at each end of this compartment. Immediately ahead of the main compartment is a buffet with kitchen accommodations so that light lunches may be served the passengers while enroute. The two compartments ahead of the buffet are the smoking room and the baggage compartment.

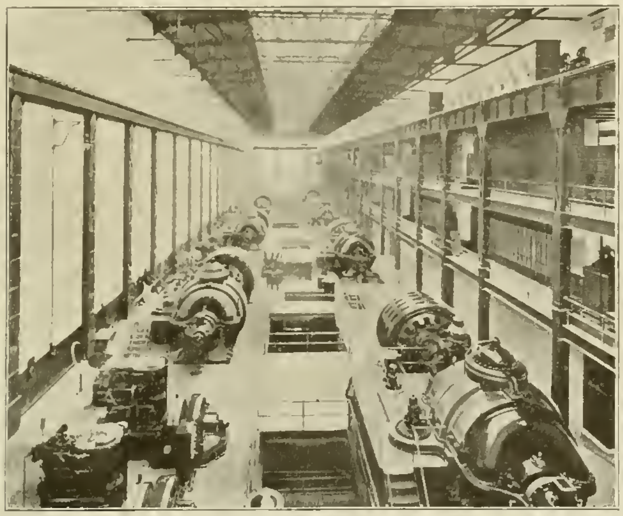
The smoking room is especially large and well furnished. Across the end adjoining the buffet is a comfortable lounge and along each side are large arm chairs. The lounge and the arm

Among the manufacturers' representatives present at the session were W. E. Ludlow, Cleveland Armature Works; E. C. Rutherford, National Brake Co.; L. J. Drake, Jr., Galena Signal Oil Co.; K. D. Hequenbourg, Franklin Car Heating Co.; George S. Hastings, C. C. Blake, E. J. Burke, Blake Signal & Manufacturing Co.; W. H. Bloss, Buda Foundry & Manufacturing Co. and Messrs. Turner, Hutchins, Craig, Johnson, Parke, Leary, Ames, Newburn, Farmer, Olmstead, Clark, Donovan, Down and Burns, of the Westinghouse company.

The Baker Street & Waterloo Railway.

The Underground Electric Railways Company of London, Limited, has just distributed in pamphlet form, a very complete description of the new Baker Street & Waterloo Ry. This well illustrated description, which is presented here in abstract, is a reprint from the "Tramway and Railway World," of London.

The Baker Street & Waterloo Ry., which at the time of writing is on the the eve of being opened for service, is a line possessing



INTERIOR OF CHELSEA POWER STATION OF THE UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON.

great interest, alike from the engineering, the traffic, and the public points of view. While it is a "tube" railway, and as such is not a novelty, it presents many features which are radical departures from any designs which have been carried out before. The road was incorporated by an act of parliament and construction was authorized in 1893 but construction work did not start until some time later. When Mr. Yerkes obtained control the work was pushed forward energetically.

The total length of the railway when completed will be five and a quarter miles, but of this about half a mile is not yet under construction. The extremities of the line are now nearing completion, but they do not interfere with the working of the route from Kensington Road to Baker St., a distance of three and one-eighth miles.

The railway will serve many of the most important districts in London, running as it does through the heart of the West End shopping center, and the region of clubs, hotels, and theaters, while at its southern end it is in the center of a great working class population. This fact, together with the numerous interchange facilities with other railways, points to a very heavy traffic. Over a year ago Mr. Stephen Sellon prepared a report for the company, in which he estimated that the line will carry 35,000,000 passengers per year. The time recently shown by experimental running will be 12 minutes from Baker St. to Waterloo. When the whole length of the road is open, it is expected that with an average speed of 14 m. p. h. it will be possible to travel from the Elephant and Castle to Paddington in 22 minutes. The only public transit service hitherto covering the whole route of the new railway is afforded by omnibuses. These carry about 183,000 passengers per week-day. Taking all considerations into account it is expected that the new road will carry 35,000,000 passengers annually. The three-minute service arranged for is ample to carry even more.

Construction Details.

Speaking generally the railway is on a gradually ascending gradient all the way from the Thames to Paddington. The inclines are not severe, the steepest being 1 in 60, but curves are numerous, and the radius of the sharpest is 330 ft. As in other railways of the class, each track is in a separate circular tunnel which is lined throughout with cast-iron segments bolted together. The whole of the tunnels, with a small but important exception, are in the London clay, which is such a suitable material for excavating. There are three internal diameters of the running tunnels, 11 ft. 8¼ in. on straight track and on curves of not less than 1,320 ft. radius, 12 ft. on curves of not less than 660 ft. radius, and 12 ft. 6 in. for sharper curves. At the passenger stations each tunnel is of 21 ft. 2½-in. diameter. The permanent way is of exceptional weight and strength, and presents several new features. Elevators are installed at all the stations, as well as powerful ventilating fans so as to afford pure atmosphere in the tunnels. The whole railway from end to end, including the stations, may be regarded as fireproof. Neither pains nor money has been spared to secure this end. The cars are built entirely of non-combustible materials, steel being the chief element. The working of the trains is on the multiple-unit control system. Three sub-stations are operated, which receive their energy from the great Chelsea power station of the Underground Electric Railways Co.

The tracks are of standard gage and are supported on a road bed as shown in the accompanying section through the track and lower segment of the tunnel casing. It will be noted that the bottom of the invert is filled with a bed of concrete with sloping sides. The concrete was not quite so high when laid as the bases of the ties were to be. The ties were laid upon it, and then wedged up to their proper level. Fine concrete was next run under the ties to fill the space, and between the ties the spaces were filled with concrete and a top covering of loose crushed granite. A cross iron lip is bolted below each tie, and this lip is sunk in the concrete so as to prevent the tie from moving endways. An angle iron is placed at each edge of the bench of concrete to prevent the grout from running out. The ends of the ties overhang the edges of the concrete bench and are bedded in crushed granite. As the track rails are above the overhang, a valuable elasticity is obtained. The ties, of Karri wood, are practically fireproof, and may almost be described as everlasting. They are square in section, and their lower sides taper upwards at the ends so as to conform with the slope of the

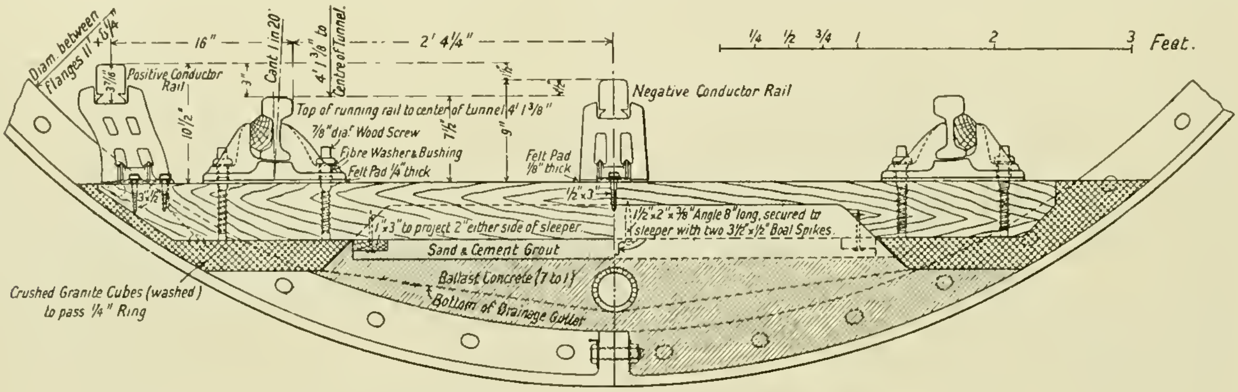
INTERIOR OF TUNNEL AT A CROSS-OVER.

tunnel tube. The ordinary ties are 6 ft. 6 in. long, 14 in. wide, and 5 in. thick. Those for the insulators are 7 ft. 7 in. long. The joint ties are 10 x 5 in. x 6 ft. 6 in.

The running rails are the standard 90-lb. bullheaded British railway rail, and were supplied in varying lengths in order to keep the joints opposite one another on curves. The rail chairs are held

down to the ties by screw bolts. A fiber bushing is put around the neck of the bolt where it goes through the chain. Under each chain is placed a felt pad one-quarter of an inch thick, which deadens the noise of the trains.

The conductor rails, of which there are two, a positive and a negative, are of a different pattern from any others used in London. The section, which may be seen in the illustration of the track section, is practically a solid square. The object was to save space vertically, an important matter in a tube railway, and at the same time to get the large cross sectional area. This section weighs 85 lb. per yard.



SECTION THROUGH TRACK AND LOWER SEGMENT OF TUNNEL.

The electrical conductivity is high; the resistance is not more than 6.4 times that of pure copper.

The positive conductor rail is carried on specially-shaped insulators mounted on the ends of the ties close to the wall of the tube, while the negative rail is placed centrally on a lower type of insulator between the track rails. The positive insulator is of the peculiar shape which may be seen in the illustration, and has been designed to lie close to the curve of the tube. The insulators are of vitrified earthenware, and are fastened to the ties by malleable iron clips with felt pads below them. The negative rail insulator is a square solid block with a groove in the center for the rail, and it is held down in a similar way.

The conductor-rail joints have each four bonds, two long and two short on each side. They are of the flexible plaited-wire type, and were supplied by the American Steel and Wire Co. The total cross-section area of the four bonds is 1.4 sq. in.

Power Supply.

The Chelsea power station of the Underground Electric Railways Co., of London, supplies the electric energy for working the Baker Street and Waterloo Ry.

In this station the boilers are arranged on two floors. At present there are 64 Babcock and Wilcox boilers, with space for increasing the number to 80. Chain grate mechanical stokers, superheaters, and economizers are installed. In the engine room are eight Westinghouse turbo-generators of about 7,500 h. p. capacity each, and there is space for installing two more such units and one smaller one, which will bring up the total capacity of the station to 80,000 h. p. The steam turbines are coupled to 5,500-kw., three-phase, alternating current generators. The pressure generated is 11,000 volts, and the frequency 33⅓ cycles per second. Current is distributed by underground cables to 24 sub-stations.

Feeder Arrangements.

The high and low-tension railway feeder cable arrangements are comparatively simple, as there are only three sub-stations on the railway. The conductor rails are divided into long sections so that the low-tension feeders are not of great length. Two high-tension cables are hung on the tunnel walls on iron brackets which are bolted to the flanges of the rings of the tubes. Four low-tension cables also run along each side supported on separate brackets. These cables are for the elevators at the stations, for lighting, and for telephones.

Sub-Stations.

The chief sub-station for the railway is at Charing Cross, while of the other two, one is in the depot at St. George's Circus, and the other at Baker St. In the Charing Cross sub-station there is a large installation. It is entirely underground, part of it being beneath the Thames Embankment gardens. The St. George's Circus and Baker St. sub-stations are plain brick and steel buildings, and the former is erected on heavy girders spanning the end of the depot tracks. In all cases the arrangement of the machinery is similar. Below the ground level is a basement for the cables between the rotary converters and the switchboard, and from the switchboard to the exit to the railway tracks. Along one side of the main floor runs a gallery about 23 ft. wide, on the top of which the transformers and high-tension bus-bar compartments are erected. The switchboards are erected on the wall under the gallery, and between the back of this wall and the outside wall of the building are the high-tension isolating switches, the 11,000-volt cables coming in on that side. The main floor space is occupied by the rotary converters, and at either end room is found in the one case for blowers supplying the air blast for cooling the transformers, and in the other for an air compressor and a small motor-generator. The former supplies the compressed air for the electro-pneumatic automatic signaling on the railway, and the latter the low-pressure continuous current which is sent out to the track rails in connection with the same purpose. In the Charing Cross sub-station there are four rotary converters of 1,500-kw. capacity each, while at Baker St. and St. George's Circus there are in each case two of 800-kw. capacity each, with room for a third.

Passenger Stations.

The passenger station buildings, and the interior walls of the stations themselves present a very handsome appearance. The ground plans of the buildings vary in shape and size according to the site available, but the elevations of those above ground are similar. Each station consists of a spacious ground floor with a mezzanine floor above, the entrances, exits, and windows being schemed to form a series of spacious arches. The roofs are left flat, so that additional floors for occupation as offices or dwellings can be erected when desired. The structure consists of a steel frame-work which is clothed with terra-cotta glazed blocks of a dark but brilliant ruby-red color. Large gilded letters forming the name of the station are in one piece with the blocks, and stand out in bold relief. Some of the stations have two shafts with two elevators in each, while others have only one such shaft, but with three elevators in it. Each elevator has a capacity for 60 passengers. All the station buildings are fireproof.

Lighting Installations.

The tunnels are lighted throughout with 16-candle-power incandescent lamps, spaced about 40 ft. apart. The tunnels are to be white-washed throughout, and when this has been completed the lighting will be much more effective. The lamps are run on a 220-volt three-phase circuit, the current being obtained from the lighting transformers in the sub-stations. Each lamp is connected across two of the phases, some between one pair and some between another.

The passenger station buildings and the platforms are lighted both by arc and incandescent lamps. The former are run off the 550-volt circuit used for working the elevators, but should that at any time fail they can be switched on to the power circuit of the track rails, and not only so but they can be connected to either the up or

the down track at will. The lamps are wired in groups of five in series. The incandescent lamps in the stations are intended for use in emergency, should the arc-lamp circuits go wrong. Half of these incandescent lamps are fed by current from the public sources of supply, and half from the 220-volt three-phase circuits, and they are always kept lighted, so that should the arc lighting fail the stations will not even temporarily be in darkness. There are thus four separate sources of current supply for lighting the stations, and the risk of failure of light is reduced practically to zero.

An extensive site was acquired for a car house and shops for the railway. The extreme length of the ground is about 700 ft., and the greatest breadth 324 ft. A large portion of the site is occupied by sidings for the accommodation of trains, there being altogether 14 tracks, all communicating with an incline which runs down a tunnel to the railway below.

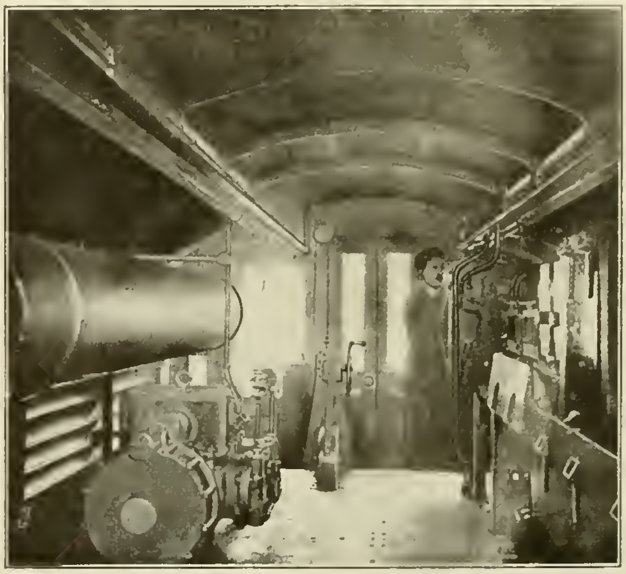
The buildings upon the site include a car-repair shop, paint shop, sub-station, boiler-house, and offices.

Rolling Stock.

The cars are almost entirely composed of steel. This is one of the precautions taken to render everything about the railway fireproof. The cars were built by the American Car and Foundry Co. While the parts were manufactured in the United States, the whole erection work was done in works which the company has started at Trafford Park, Manchester. In general appearance these vehicles do not differ materially, except for the projecting rivet heads, from cars built of wood, but the method of obtaining strength is radically different. The sides of the car body form steel-plate girders of great depth, and the floor is supported from these by steel diagonal ties. The framing is of steel angles, and the floors as well as the sides are of steel plate. The whole construction is of such strength as to be well able to withstand shock from collision. The only wood used, and that very sparingly, is for some of the internal fittings, and this wood has been treated by the non-flammable process so as to render it incombustible.

The drawings show the general arrangement of the cars; 108 of them have been ordered, and 95 are now ready. Six cars will be operated as a standard train. There will be a motor car at each end, with four trail cars between. All the cars are of the same

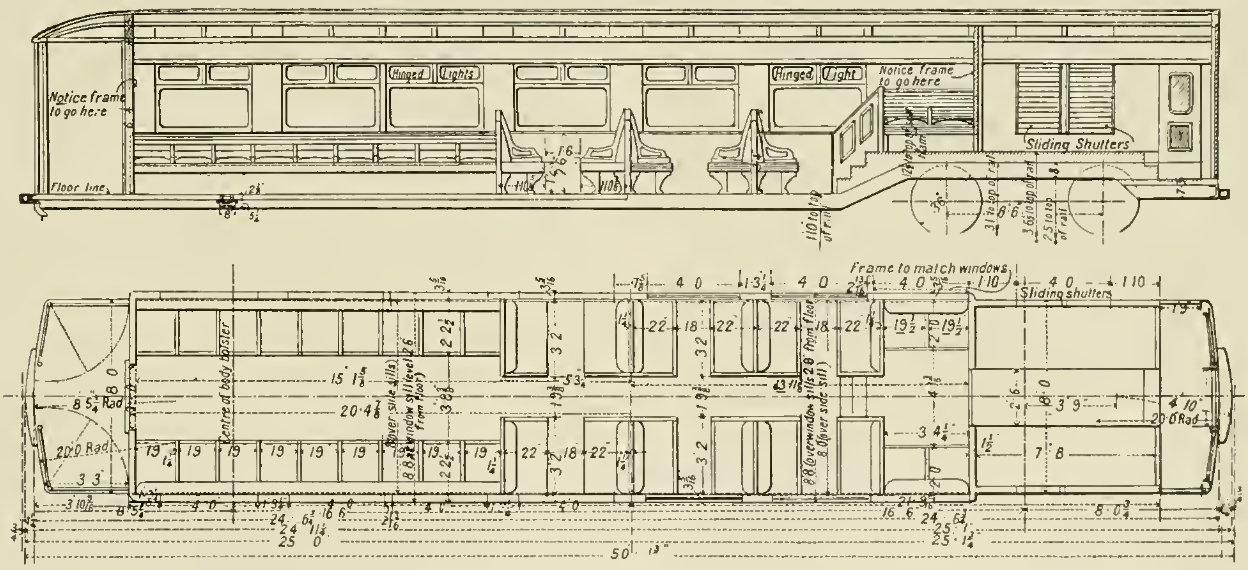
All the control apparatus, as well as the air compressors, is carried in a steel cab at the driving end of the car. Here the contactors and circuit-breakers are hung from horizontal slate panels supported by rigid steel framework. The form of construction was adopted because the small diameter of the tunnel does not allow



INTERIOR OF CAB ON MOTOR CAR.

sufficient room for the apparatus to be carried under the car. It is also considered safer on the tube line to have the apparatus enclosed in the cab.

A very complete block signal system has been installed, worked with a pressure of 60 volts between one of the track rails and the negative conductor-rail. Automatic train stops are included in the signal system.



INTERIOR ELEVATION AND FLOOR PLAN OF MOTOR CAR.

dimensions. Owing to the limited head room in a tube railway it is necessary to keep the floor of the car as low as possible, and in order to get the motor truck, motors, and 36-in. wheels into the space the floor of the car above the truck is raised as shown in the drawings. This method of construction, it may be remembered, is used on the motor cars on the Waterloo and City Ry. The rest of the floor of the car is only 22 in. above the rails. There are two G. E.-66 motors of 200 h. p. each mounted on the driving truck of each motor car and all the motors are controlled from one cab by the Sprague-Thompson-Houston multiple-unit system.

On week-days trains run at intervals of two or three minutes, while on Sundays the time between trains is about four minutes. Train attendants open and shut the iron-work gates on the car platforms after the style carried out on the Central London Ry. The fare for any distance is two pence, and books of 25 tickets can be bought at any station at four shillings each. Workmen's tickets are issued on week-days up to 7:58 a. m. for a return fare of two pence. Mr. J. P. Thomas, formerly of the Central London Ry. and the Great Northern and City Ry., has been appointed superintendent of the line.

THE STREET RAILWAY REVIEW

AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE

KENFIELD PUBLISHING CO.,

45-47 PLYMOUTH COURT, CHICAGO, ILL.

Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:

New York—39 Cortlandt St. London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:

Austria, Vienna—Lehman & Wentzel, Karntnerstrasse.

France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.

Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.

New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.

Queensland (South), Brisbane—Gordon & Cotch.

Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

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This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XVI APRIL 15, 1906 No. 4

CONTENTS OF THIS NUMBER.

HOW THE OTHER FELLOW CAN HELP YOU.

It is usually true, that our more important railway engineering undertakings are properly built, but it is also true that in the construction of a more recent railway or power house there are introduced many decided improvements that tend greatly toward better service at lower operating and maintenance costs. This, of course, is speaking in a general way, but it is nevertheless a fact that many large enterprises are heralded as "perfectly built" and yet often develop defects in detail that seemingly could not have been provided for until after actual service had begun.

This situation is equally applicable to both large and small undertakings. It also checks well with the often expressed thought that a detailed description of any undertaking is of much value to others having to do with similar work. This good can be largely gained by reading the descriptions of recently built enterprises. Illustrations help to make a technical description attractive, but the true value lies in the written statements of how and why different parts of the work were executed.

Such articles appear in this and other trade magazines from month to month; in fact, there are so many that one could hardly find time to read them all. Thus the reader's power of judgment is called upon to choose for his careful reading, such articles as will be the most help to him in his daily work.

When especially worthy descriptions are printed, comment is made in these columns and the special features are mentioned in a brief way. In this issue there appears an abstracted description of the Baker Street & Waterloo Ry. which is the most recently completed portion of the London "tube" system. There is also presented a description of the new generating station for the electrical equipment of the Pennsylvania Railroad's suburban and terminal lines near New York City. Both of these articles are carefully made abstracts of accurate descriptions of these magnificent undertakings. Such portions as describe features of local interest have been largely eliminated so that the remaining descriptive matter is a concise description of those features of general engineering practice that are applicable in a more or less modified form to any electric railway.

SOME HINTS FROM LONDON.

The construction of the underground railway lines of London has been in progress for some time, and now the first completed portion is ready to take up its task of handling a part of the London traveling public. The general design of the new work has been handled in a careful way by some of the more prominent engineers of the world. The work has been thoroughly done in a manner that presents many interesting details. This, the first completed section of the great underground electric system of London, will be a model for the other lines now in their various stages of completion. The present plans include a total route length of 74.25 miles to be operated by the Underground Electric Railways Company of London, Limited.

The total length of the new Baker Street & Waterloo division will be five and a quarter miles. In this distance there are twelve stations, nearly all of which are at points of intersection with other main arteries of travel. Each of the tracks is built within a separate circular tunnel, lined with cast-iron segments bolted together, and having a diameter, on straight track, of eleven feet, eight and one-quarter inches, which dimensions are increased to a suitable amount on curves and at stations. By the elimination of all inflammable material in the tunnel itself, the stations and rolling stock, the entire construction has been made as thoroughly fireproof as is possible. The details of the track construction were designed very carefully with a view to making the roadbed substantial, yet elastic and so arranged that the cost of repairs to rails and ties would not be excessive.

As described and illustrated elsewhere in this issue, the single track in each tunnel is built upon a bench of concrete which rests on the bottom of the invert of the tunnel casing. The upper surface of this concrete bench is peculiarly shaped to receive the ties and restrain them against creeping. The construction details are as follows: The concrete was first deposited in the bottom of the tunnel casing, this mass having its upper surface sloped toward the center and of such a width as to give a bearing for three-fourths of the length of the ties and equally spaced on each side of the track center line. The ties were then distributed prop-

erly spaced and blocked up to an accurate surface. The concrete mass with its sloping sides was next brought up to a point just below the upper surface of the ties, special care being taken to fill the space directly under the ties with a strong grouting of sand and cement. On the bottom of each tie, equally spaced from the center line and at the sloping edges of the concrete, were secured angle irons, spiked parallel with the track rails. These angle irons effectually prevented the sand and cement grouting from spreading out on the bottom of the tunnel. The mass of concrete as brought up between the ties will prevent any creeping motion along the axis of the tunnel. To prevent any possibility of the creeping of a tie along its own axis, an angle iron was spiked at the lower side of the center of each tie and when once embedded in concrete these angles effectually resist the tendency of the ties to move toward the side of the track on curves.

The ends of the ties overhang the concrete bench supporting them by about one foot. These ends are bedded in crushed granite. This arrangement, with the ties supported rigidly on the concrete bench between the rails and resting on ballast at the ends under the rails, furnishes an element of elasticity which is said to bring about especially beneficial results, both as to lessening shocks to the rolling stock and deadening the noise of rapidly moving trains in the small enclosure of the tunnel. The ties are made of Karri wood, which is especially close grained, heavy and practically fire-proof. In section, the ties are square with their lower sides beveled at the ends to conform with the slope of the tunnel tube.

In this apparently permanent form of roadbed construction provision has, however, been made for the renewal of the ties. As was mentioned earlier, there are three short lengths of angle irons fastened to the bottom of each tie. The two which confine the edges of the concrete bench are longer than the breadth of the base of the tie and the one spiked underneath the center of the tie, for the purpose of preventing a side movement, is slightly shorter than the breadth of the tie. Thus it is seen that when a tie is taken out for renewal the short angle iron at the center comes up with the tie and the two remaining angles at the sides of the concrete bench remain firmly bedded in the concrete, necessitating the withdrawing of the spikes, which in the first place fastened them to the tie. When a new tie is to be put in, it is first marked so that it will be properly placed over the spikes in the angles at the edges of the concrete bench. The proper position of the rail chairs are also marked before the new tie is put in, thus assuring that the previous alignment will be maintained.

As each rail is supported on a chair which holds the base of the rail a short distance above the tie, and as it is a comparatively simple matter to remove the rock ballast from the ends of the ties, it is thus seen that the problem of replacing a tie which ordinarily is so rigidly held in the road bed becomes a comparatively simple matter; and it is especially simple when contrasted with some other subway roadbeds in which, when it is desired to change ties, quite a large number of them must be unspiked and swung around parallel with the rails, before one can be withdrawn for renewal.

Two sizes of ties are used, each fourteen inches wide and five inches thick. The ordinary ties are six feet six inches long; those ties carrying the third rail insulators are seven feet seven inches long.

By varying the length of the running rails from about thirty-five feet to thirty-seven feet, the joints were kept opposite on curves as well as on straight track. As the rails were taken into the tunnel through a vertical shaft extending down from the river bank to the bore, the usual length rail of forty-five feet could not be handled. The running rails are of the bull-headed type and weigh ninety pounds per yard. At each tie the rails are supported by chairs fastened to the ties with screw-bolts rather than with spikes. Around the neck of each bolt where it passes through the iron base of the chair a layer of insulating material was provided to prevent the wandering of any leakage currents. Between the chairs and the tops of the ties is a pad of felt one-quarter of an inch in thickness which serves to deaden the noise of the trains.

There are two working conductors. A positive rail is supported outside of the track with its center sixteen inches from the gage of the nearest running rail and its top three inches from the top of the running rail. The negative conductor is placed midway between the two running rails and has a top surface one and a half inches above the top of the running rails. Each of the conductor rails is rectangular in section with grooves rolled in its lower outside faces to permit of joining by under-hung clamp bars. The conductor rails weigh eighty-five pounds per yard and are made of an especially soft steel having but five one-hundredths per cent of carbon in its chemical composition.

Power for operating the trains is obtained as 11,000-volt current from the new Chelsea station of the Underground Electric Railways Company. There are three sub-stations in the new line slightly over five miles long. The interior arrangements of the sub-stations are similar. One of these sub-stations is built entirely under ground so that it was necessary to make the floors, walls and roof of the building absolutely water-proof.

An interesting scheme has been utilized where the electrical continuity of the third rail is broken in front of each sub-station for the purpose of feeding in both directions. At each sub-station an independent section of rail slightly longer than an entire train length is electrically separated from the remainder of the working conductors although it forms a part of the one continuous rail mechanically. In this way should there be a ground on the section of rail between two sub-stations, and should a train approach the sub-station from an operating section of rail, the train line cables between the forward and rear shoes would not connect the charged rail with the rail on which the circuit breaker was open on account of the ground. The train in leaving the charged rail would first have to cross the independent section before its shoes would come in contact with the grounded or inoperative rail. This feature, it will easily be seen, not only prevents the opening of the circuit breaker on the operative rail, but also does away with the possibility of short circuiting the operative rail through the cables of the car and to a damaged or grounded rail and distributing trouble. Such a feature should prove of much value in a tunnel railway operating fast trains on short headway.

The tunnels are lighted throughout with sixteen-candle-power incandescent lamps placed forty feet apart. These lamps are hung above the cars so that their light will be more evenly distributed and no flashing appear in the windows as the cars pass the different lamps. The lamps will be kept burning at all times. The illumination is made more effective by a coat of whitewash spread over the entire tunnel lining.

The rolling stock equipment has been carefully designed with a view to safety as well as to satisfactory operation. One interesting feature from a safety standpoint is the placing of horizontal corrugations in the manganese-steel buffers to prevent "riding-up" in case of collision. All the controlling apparatus for the electrical equipment is placed in a cab at the head-end of the train and over the motor trucks, the rear trucks on the motor cars being without motors. Each train is lighted from two independent cables, one connected with the forward shoe of the train and one with the rear so that in the absence of the heavy connecting cable usually joining all third-rail shoes in American multiple-unit trains, there will be no chance to connect separate sections of the third rail through the lighting cables. With this arrangement when the train is passing over a break in the third rail one-half the lights will go out as the train crosses a gap greater than the span of the shoes on the motor cars, and will be lighted again some time before the other half of the lights go out as the shoes of the rear motor car pass the same gap.

These interesting features of construction serve to illustrate how carefully the design of the great underground system of London is being carried out.

THE TRACTION SITUATION IN PHILADELPHIA.

Having routed the political clique in Philadelphia which was accused of handing out franchises to the detriment of the public, Mayor Weaver has recently taken an active part in changing the traction affairs of the city. Various franchises held by the Philadelphia Rapid Transit Co. had lapsed and unless this company could secure from the city the extension of time necessary to complete the proposed work, the company faced a situation which included the following disagreeable conditions:

The veto of an ordinance granting it three more years in which to finish its Market St. subway; the forfeiture of a number of franchises, surface, underground and overhead, which would lapse with a failure to secure an extension of its rights; the loss of

millions of dollars on the work already done; an active competitor in the Philadelphia & Western Railroad Co.; and, finally, the threat of Mayor Weaver that the city would take up all the subway and elevated work itself, finish it, and rent it to the highest bidder.

Provided it was granted the requested extension of time to complete the Market St. subway and to protect its other franchises, the Philadelphia Rapid Transit Co. agreed to relinquish a number of important franchises now held by it. Besides this, the company undertakes to commence the construction of the Broad St. subway at once, and to complete it from Walnut St. to the end of Broad St. by June, 1909. This is a distance of eight miles and the estimate on the work places the cost at $24,000,000. It also agrees to complete within the same three years' time a loop subway from Broad St. under Walnut to Fifth St., thence to Arch St. and then west under that highway to Broad St. The "loop" will cost about $4,000,000. The completion of the Market St. subway-elevated line will cost not less than $5,000,000, beyond what has already been expended. The Philadelphia Rapid Transit Co. agreed to do this knowing that the majority of the franchises surrendered would go to the Philadelphia & Western Railroad Co. It has been announced in Philadelphia that this agreement has been effected.

The surrender of the franchise for a subway under Chestnut St., by the Philadelphia Rapid Transit Co., opens a route to the Philadelphia & Western Railroad Co. by which it can reach the down town portion of the city. This company, which was chartered in Pennsylvania to build a railroad from Parkesburg, east to the western limit of Philadelphia at 63rd and Market Sts., has applied for a franchise to build an elevated and underground road east across the city to the Delaware River, about five miles. Such a line would parallel the elevated and underground road now being built by the Philadelphia Rapid Transit Co.

In its application for a franchise, the Philadelphia & Western makes a proposal to pay the city two per cent of the gross earnings from passenger traffic within the city during the first two years of operation, three per cent, during the third year, four per cent during the fourth year, five per cent, during the fifth year and for 30 years thereafter. At the end of this time the property is to be turned over to the city, the company, however, having the option of leasing the road for a further period of 40 years at an annual rental of $400,000, plus the five per cent of earnings as before.

COLUMBUS AS A CONVENTION CITY.

As announced elsewhere in this issue, it has been decided to hold the next convention of the American Street & Interurban Railway Association in Columbus, O., during the week of Oct. 15-20, 1906. This choice is a particularly happy one. The middle West is being more and more recognized as a flourishing and progressive interurban field and in these pages there have been presented many advancements in electric traction which were conceived in this territory.

Of the several interurban centers in the middle West, Columbus, the capital of Ohio, is one of the most prominent. Moreover, it is especially suited, in point of accessibility, to the needs of a convention, being located in the center of the state and having direct railroad connection with every part of the United States. The city has a population of over 125,000. Therefore it is of sufficient size to care for the large body of men which will be drawn thither and at the same time will not afford. as do the larger cities, too many attractions tending to draw the interest away from the business of the convention.

The hotels of Columbus can accommodate a total of approximately 3,500 guests, and this, together with the fact that the rates obtained are decidedly less than heretofore, probably did more than anything else to influence the committee in its choice. The facilities for exhibition purposes are in every way adequate, as are those for the purposes of meeting of the convention proper. The Columbus Railway & Light Co. is one of the best equipped urban properties in the state and will afford excellent service. This company operates Olentangy Park, an amusement resort of considerable pretentions, which is a very attractive feature of the city.

Columbus is a city of a particularly pleasing appearance. The streets are broad, well-kept and for the most part shaded by fine old trees. The city contains many points of interest, including a number of state institutions, among which may be mentioned the Ohio State University.

While it is probably too early to draw an accurate forecast of convention possibilities, there is now every indication that the Columbus convention will excel all its predecessors in point of attendance and importance of exhibits made.

Work of the Standardization Committee.

As the work of the Standardization Committees of the Railway Engineering Association and of the American Street & Interurban Railway Association is a matter of considerable importance to electrical railway interests, we are pleased to announce that good progress is being made in this mutual welfare work.

There are two committees on standards; one representing the American Street & Interurban Railway Association and the other representing the Railway Engineering Association. The engineering association committee is the one which will make the active investigations. The other committee is to co-operate in a general way with the engineering association committee and is to make recommendations to the parent association which will be based upon the report of the Railway Engineering committee to be given at the completion of its work.

Secretary Swenson's office will be placed at the disposal of the Railway Engineering committee and the general notices and information blanks will be sent out from that office. By co-operating in this way, it is expected that the two committees and the association headquarters will keep thoroughly in touch, one with the other, on this work.

The Railway Engineering committee consists of the following: Chairman—H. Wallerstedt, engineer car equipment, Interborough Rapid Transit Co., New York, N. Y., Herschel A. Benedict, mechanical and electrical engineer, United Traction Co., Albany, N. Y., F. H. Lincoln, assistant general manager, Philadelphia Rapid Transit Co., Philadelphia, Pa., Paul Winsor, chief engineer of motive power and rolling stock, Boston Elevated Railway Co., Boston, Mass., W. H. Evans, master mechanic, Indianapolis Traction and Terminal Co., Indianapolis, Ind., H. B. Fleming, superintendent of maintenance of way and structure, Chicago City Railway Co., Chicago, Ill., J. M. Larned, engineer, maintenance of way, Pittsburg Railway Co., Pittsburg, Pa.

The American Street & Interurban Railway Association Committee on Standardization consists of the following: Chairman—H. C. Page, general manager, Springfield Street Ry. Co., Springfield, Mass., John Murphy, general manager, Pittsburg Railways Co., Pittsburg, Pa., H. A. Nicholl, general manager, Indiana Union Traction Co., Anderson, Ind., T. W. Wilson, general manager, International Railway Co., Buffalo, N. Y., H. Wallerstedt, engineer car equipment, Interborough Rapid Transit Co., New York, N. Y.

A considerable amount of preliminary work has been done and it has been decided that the committee will work upon the standardization of tread of wheels, brake shoes, journals, journal boxes and track for street and interurban railways. Data blanks will be sent to all street and interurban railway companies in America and the information obtained will be worked up by the committee of the Railway Engineering Association.

Electric Railway Bridge Over Niagara.

It is announced that the International Railway Co. of Buffalo, N. Y., and the Toronto Railway Co. will erect a bridge across the Niagara River below Niagara Falls. A bill has been introduced in the New York legislature incorporating the Trans-Niagara Bridge Co. with a capital stock of $1,000,000 to construct a bridge for electric railway purposes. The bill names Frederick Nicholls, E. R. Wood and D. E. Thompson of Toronto, Grant B. Schley, of New York, Robt. L. Fryer, Henry J. Pierce and Porter Norton of Buffalo and Frank A. Dudley of Niagara Falls as commissioners, five of whom are vested with the power to locate the bridge and open an office at Niagara Falls for the purpose of disposing of stock.

Though the plan is a large undertaking, it is but one feature of a large electric railway enterprise that purposes to connect Buffalo and Toronto by a double-tracked, electric line. It has been announced that this line will run from Niagara Falls to St. Catharines and Port Dalhousie, over roads now built and in operation. From Port Dalhousie, the line will run through Hamilton to Toronto. A high-speed service will be maintained, the cars being run in trains.

Selection and Training of Car Service Men on the West Penn Railways.

BY J. W. BROWN, SUPERINTENDENT OF TRANSPORTATION.

"The best are none too good" is the axiom kept well to the fore in the selection of men for car crews of the West Penn Railways Co. This system, comprising as it does 110 miles of road lying for the greater part in the rugged country adjacent to the Allegheny Mountains, call for motormen and conductors possessed of good judgment and a thorough knowledge of their work. Grades

TYPES OF UNIFORMS.—WEST PENN RAILWAYS.

reaching 14 per cent are operated over which together with the numerous curves encountered make the careful handling of cars a necessity. About 200 men are employed on the various divisions of the line.

All motormen and conductors are hired by the superintendent of transportation. The first step is a personal interview with the applicant in which his general appearance and deportment are carefully noted. Any indication of intemperance in the use of liquor or the tell-tale discoloration of the fingers showing him to be a cigarette user are sufficient reasons for non-employment. If the applicant's appearance and conversation are in his favor he is given an application blank with instructions to fill it out carefully in ink. This application pledges him to loyally serve the best interests of the company if accepted and calls for a complete record of his employment during the preceding five years, his age, occupation, nearest relatives, debts and obligations devolving upon him, names of organizations of which he is a member, use of intoxicants and the names of at least three business men are required as references.

After the application has been properly filled out, letter forms inquiring as to the applicant's character, personal habits and general fitness for the prospective position are sent to the men to whom he refers and at the same time a line of inquiry is started through other channels as to the applicant's standing in his home community. If the references are satisfactory and his standing is good, he is notified to appear at the company's office and is given an order to an oculist who subjects him to a rigid examination as to his vision and hearing, including color tests. A record card, made out in the metric system, is sent to the superintendent of transportation by the oculist.

If the applicant has successfully passed this examination an explanation of his duties is made to him, in which loyalty, sobriety and courtesy to the public are emphasized. The extra list is also explained, and the hours, wages and method of reporting for runs are talked over. He is then provided with a book of rules and a learning order and is put on a side line where the traffic and schedule will allow the regular man to give him a considerable portion of his attention. As the new man progresses he is transferred to another line and at the end of 10 days or two weeks, he is usually turned in by all the regular men with whom he has been learning.

A trial trip is then made with the division superintendent and if the new man handles his car in a proper manner the superintendent certifies his learning order which already bears the signatures of each of his instructors. Armed with this he again appears before the superintendent of transportation. An examination on rules and regulations follows, and also a talk on accidents, getting the names of witnesses, talking to anyone outside of company officials about company business and various other subjects are brought to his attention.

If he is a conductor he is then fitted out with a badge, punch, telephone key and lantern. If a motorman he is provided with a badge and a tool box containing a monkey wrench, cold chisel, punch, hatchet, screw-driver, pliers, tape and an oil can.

The dispatcher of the division to which the new employe is assigned is notified to list him in his proper place for work. Care is always taken to place him on the less important side lines first and two new men are never assigned to the same run, it being a rule of the company that at all times either the motorman or conductor must be an experienced man.

The new employe is given a few days to get a uniform, the type of which is shown in the accompanying illustration. During the summer months an overclothes suit is worn by motormen which is light and cool. These are laundried frequently to keep them neat in appearance.

In a later issue of the "Street Railway Review" the methods of keeping records and the disciplining of men on the West Penn system will be described by the writer of this paper.

Efficiency Tests of a Steam Turbine.

A series of performance tests was recently made by Ludwig & Co., engineers, Atlanta, Ga., on a 500-kw. Westinghouse-Parsons turbine, the results of which are especially satisfactory.

The turbine was designed to develop normally 750 brake h. p., with a steam pressure of 175 lb. at the turbine throttle, 150° F. superheat, 28 in. of vacuum, absolute (reduced to 30 in. barometer), when running at a speed of 3,600 r. p. m. It was particularly desired to obtain results at the turbine shaft, consequently brake tests were performed.

The turbine was subjected to different loads by means of a water absorption brake. During the saturated steam tests approximately

RESULTS OF ONE-HOUR EFFICIENCY TESTS.

LOAD		STEAM			STEAM CONSUMPTION			
						POUNDS PER BRAKE H. P. H'R.		
Approx.	Brake h. p.	Press lb.	Quality	Vacuum in. abs.	Total lb. per hour	Test	Guaranteed	Better than guar'd per cent
SATURATED STEAM								
½	396.0	151.2	99.47	28.03	5908	14.92	15.7	5.5
¾	584.3	152.6	99.50	28.03	8211	14.05	14.8	5.1
Full	762.3	153.2	99.45	27.70	10429	13.68	14 3	4.2*
SUPERHEATED STEAM, 105.2° SUPERHEAT								
Full	763.9	153.3	.....	28.0	9334	12.22	12.7	3.0**
REDUCED VACUUM								
Full	722.9	148.8	99.53	26.03	10781	14.91	....	...
1½	1145.5	142.6	99.58	26.30	10429	15.08	....	...
Full	678.7	148.9	99.73	24.10	10764	15.[illegible]6	....	...

*When corrected for vacuum, 6.08 per cent better than guarantee.
**When corrected to 150° superheat, 11 7 lb. or 7.9 per cent better than guarantee.

dry steam was insured at the turbine by slightly superheating the steam as it left the boilers. The steam used by the turbine was passed into a surface condenser and the condensation weighed by the alternate tank method, proper corrections being afterward applied. The condenser leakage was averaged from tests made before and after the economy tests. The gland leakage was likewise separately determined; also the differences in height of the water in the hot well of the condenser before and after the tests.

were allowed for. All the instruments used during the tests, such as scales, pressure gages, mercury columns and thermometers were carefully calibrated with standards. Observations of steam pressures and temperatures were made close to the turbine throttle; vacuum directly at the turbine exhaust. Speed was determined by a positively driven reciprocating speed counter. All steam pressures referred to in this report are gage pressures, not absolute pressures.

A study of the tests shows that the steam consumption decreases 1.46 lb. per brake h. p., with 105.2° superheat. This corresponds to about 10.2 per cent decrease per 100°. Numerous tests have shown that the steam consumption of Westinghouse-Parsons steam turbines, changes from 3.5 to 4 per cent per inch of vacuum. The decrease in steam consumption then is about 9.2 per cent per 100°. Applying this correction in turn to the water rate obtained with superheated steam, it appears that under the conditions for which the turbine was designed, namely, 150° superheat, the water rate would have been 11.7 lb. per brake h. p. hour.

The general effect of increasing vacuum is to lower the steam consumption more rapidly as higher vacua are reached. Conversely, with vacuum below normal the steam consumption will increase less rapidly as the vacuum falls.

On account of the different loads carried during the several tests, it was neccessary to reduce the water rates to one basis, namely, to the given load. When this had been done for approximately full load these results were obtained:

Total increase in water rate per 1-in. decrease in vacuum in per cent of original water rate=3.67 per cent.

27.7 to 26 in. vacuum=4.87 per cent.
26.0 to 24.1 in. vacuum=2.44 per cent.

These results indicate the desirability of high vacuum; also, should the vacuum fall considerably for any reason the result would not affect the economy relatively as much for a small decrease.

The tests run for determining the steam consumption at no load gave the following results: load, 5.8 h. p.; steam pressure 159 lb.; quality of steam, 99.51 per cent; vacuum 27.99 in.; steam consumed per hour, 712 lb. The light load shown during this test was caused by the friction and windage in the water absorption brake. The given steam consumption, corresponding with the practically no-load run of the turbine, represents the amount required to overcome the internal losses, and a comparison of this test with the full-load test shows that this no-load steam consumption amounts to seven per cent of the full-load steam consumption with saturated steam. Assuming that these losses remain constant up to full load, the practical efficiency of the turbine will be 93 per cent, and the steam consumption will then be 12.7 lb. per horse power with saturated steam, and 10.75 lb. with 150° superheat, these figures being mainly of comparative interest.

The speed regulation test showed unusually good governor performance under wide ranges of load. The corresponding extreme speed variations were as follows:

½ load to 1½ overload: 84.3 r. p. m. or 2.3 per cent.
No-load to full-load: 108.4 r. p. m. or 3.0 per cent.
No-load to 1½ overload: 124.7 r. p. m. or 3.4 per cent.

Repeated tests with a full load suddenly thrown off and on gave from no-load to full-load an extreme speed variation of three per cent, and from full-load to no-load 2.6 per cent.

A special test was made on the performance of the automatic safety stop. During this test the safety stop operated at 3,780 r. p. m., corresponding to about five per cent above the normal running speed of the turbine, 3,600 r. p. m.

The turbine was designed to sustain a continuous load of 50 per cent above full load rating. A test was made at this load, and at 26 instead of 28 in. vacuum. The turbine easily sustained this for one hour at an overload of over 50 per cent, with an increase in steam consumption of .17 lb. per brake h. p. hour, which is equivalent to 1.5 per cent increase above the full load steam consumption.

These tests also indicate that under practical conditions of service, where vacuum is liable to fall from 28 to 26 in. on overloads, the steam consumption of the turbine between one-half load and 50 per cent overload varies by only 4.5 per cent from the average. With a uniform degree of superheat the variation would presumably be still less. The general operation of the turbine and valve and governing mechanism throughout the tests was satisfactory in every respect.

Progress at Helena, Montana.

On September 11, 1905, the public service utilities of Helena, Montana, were bought, reorganized and consolidated under the holding corporation known as the Helena Electric Light & Railway Co. The amount of the transaction was $2,350,000, which covered electric railway, electric light and gas lighting properties. During the month of February, 1906, the traffic on the railway was nearly four times that of the corresponding month of 1905, and the proceeds from the lighting service were also very materially increased.

Electric power is supplied to the Helena Light & Railway Co. by the Missouri River Power Co., and the organizations are united in the ownership of the central sub-station, from which power is distributed for the public service. The agreement for power supply calls for a rate at a maximum of utilziation of $25 per h. p. year. Because the maximum is not at present utilized, there is a large margin for increase of consumption by the light and railway company without increase of operating expense.

There are about 18 miles of track in the railway system, a great deal of which will be reconstructed. Before the reorganization, the annual income from the railway property was about $62,000, and from the lighting property, both gas and electric, about $151,000. The combined operating expenses were about $143,000, making the ratio of operating expense to gross receipts 67

HELENA SUB-STATION. HELENA LIGHT AND RAILWAY CO.

per cent. A careful estimate of operating conditions after the contemplated improvement places the gross receipts at $255,000 and the operating expenses at $147,000, thus reducing the ratio to 57 per cent. The estimate for improvement includes $115,000, to be devoted to reconstruction and extension in general, and $25,000 for the relaying of tracks and replacement of overhead construction on the main street in Helena. The contract for this work has been let to J. G. White & Co.

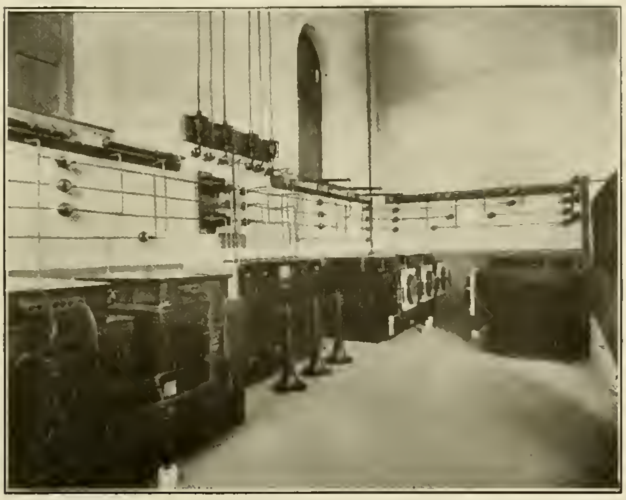
The new sub-station of the Helena Light & Railway Co. is the outcome of a fire which some time ago totally destroyed the company's combined power plant and sub-station. All electrical service was for the time being discontinued and as an illustration of what may be done in these progressive days, it is worthy of note that within 50 hours after the time of the fire a temporary sub-station had been installed and service resumed.

The building is 40 x 85 ft. in size and is of simple and effective design. It is one story high and has a basement 7½ ft. high. The height of the building from the peak to the floor is 30 ft. Rubble masonry is used in the construction of the walls.

The basement, which is reached by an iron stairway in the front corner of the main floor, contains lockers, a bath and lavatory

arrangements. It also contains the busses and machine leads. The roof is supported by iron trusses and purlins. The roof is constructed of cinder concrete in which is embedded expanded metal to the depth of eight inches, the whole being covered with corrugated steel. The building is served throughout its length by a traveling crane.

As earlier mentioned Helena obtains its power supply from the plant of the Missouri River Power Co., located at Canyon Ferry. The high-tension lines are brought into the sub-station from the



INTERIOR OF HELENA SUB-STATION TRANSFORMER HOUSE.

rear, passing through the choke coils, lightning arresters and oil-switches with automatic trips. They consist of two three-phase, 11,000-volt lines, each line switch mounted on high tension insulators.

Nine transformers with primaries wound for 11,000 volts are included in the lighting equipment with room for three more. Three of these transformers deliver current at a secondary pressure of 363 volts for the operation of two 175-kw. Westinghouse rotary converters, two 75-kw. motor-generator sets and three General Electric transformers for the operation of the series-arc circuits. The other six transformers supply current for power as well as lighting through the 2,200-volt distributing circuits.

The direct-current equipment consists of two 175-kw. Westinghouse, 60-cycle, rotary converters; two 75-kw. Westinghouse motor-generator sets, one 11.5-kw. Westinghouse motor-generator exciter set and a Westinghouse air compressor. The motor-generator sets are driven by type-C motors.

Owing to the frequent occurrence of electrical storms during certain seasons of the year in Montana a special method for exciting the rotaries has been introduced. When operated under self-excitation, the machines would fall out of step with every flash of lightning. Under the present method the rotaries are excited, either singly or in parallel, from an entirely independent and separate source from the machines, a permanent field is maintained and the motor-generators work in parallel so absolutely that they are never thrown out of synchronism. This arrangement enables the power factor to be regulated as desired and it is claimed that the 60-cycle rotary, if separately excited, may be depended upon during the most dangerous electrical storms.

The Aurora, Elgin & Chicago Merger.

The merger of the Aurora, Elgin & Chicago, the Elgin, Aurora & Southern and the Cook County & Southern Electric Railroad companies, under the title of the Aurora, Elgin & Chicago Railroad Co., was ratified by the stockholders of all the companies at their special meetings held on March 20th. Practically the same board of directors and officials that served on the Aurora, Elgin & Chicago Railway Co. will be re-elected to their respective positions in the new company.

The Aurora, Elgin & Chicago Railroad Co. has recently opened a cemetery branch, three miles long, which leaves the main line at Bellewood, and is now in operation as far as Oak Ridge. Later, this branch will be extended to Mt. Carmel Cemetery.

New Report Sheet of Atlantic City & Suburban Traction Co.

Increased attention is being given to the making out of daily reports on all matters pertaining to the operation and maintenance of electric railways. Many roads are using separate blanks for the report of each department and for each division of its lines. This naturally requires considerable time and expense in keeping the daily reports checked up. As a result an effort is being made to simplify the method of keeping records and a variety of forms have been adopted by different companies.

The Atlantic City & Suburban Traction Co., Atlantic City, N. J., has recently adopted a form which was prepared under the direction of General Manager E. C. Folsom. The form, which is printed on both sides and folded once, embodies all necessary reports of the preceding day. The front cover is in the nature of a "Defect Card" on which are entered the location of the car at the time of the trouble, the name of the line, number of the car, the time of taking and leaving the car and the general condition of the car and its equipment. The interior of the form is a general trip record, which is reproduced herewith. On the back cover are entered the trips lost and the causes, the total number of trips made over the various divisions and spaces are also provided in which the conductor and motorman sign for the time they have worked.

The Atlantic City & Suburban Traction Co. has found this new report sheet to be very satisfactory and expects to extend its use to the other properties which it controls.

LINE 190

RUN No.

MILES RUN

TRIP		STARTING TIME*	Car No.	Reg. No.	REGISTER		ATLANTIC CITY AND PLEASANTVILLE				
					Cash	Tickets	Cash	Reg Tickets	Comp.	Em-ployes	Miles
1	O										
	I										
	O										
18	O										
	I										
TOTALS											

Reg. Tickets .		Cash Fares .	
Comp. . . .		CASH . . .	$
Employes . .			

CAR HOURS

TRIP		PLEASANTVILLE AND LINWOOD					LINWOOD AND SOMERS POINT				
		Cash	Reg. Tickets	Comp.	Em-ployes	Miles	Cash	Reg. Tickets	Comp.	Em-ployes	Miles
1	O										
	I										
	O										
18	O										
	I										
TOTALS											

REMARKS

RECORD USED BY THE ATLANTIC CITY & SUBURBAN TRACTION CO. (ORIGINAL 11 x 9¼ IN.)

Importance of Scientific Accounts.

BY SEYMOUR WALTON, C. P. A.

While it is true that many street railway companies, both city and interurban, are provided with a satisfactory system of accounting, there is no doubt that the majority are lamentably deficient in this respect. In many instances too much dependence has been placed on men who are good ordinary bookkeepers, able to keep the accounts accurately and honestly, but who have not been trained in devising methods that will furnish all the information that should be given the managers of the road in order that they may at all times have an intelligent idea of the workings of every part of the system.

The importance of accurate and detailed information is not always realized by the operating department. As long as the operating officers know in a general way what the results are at the end of any given period, they are apt to be content, especially if each period shows an improvement in net results over the previous corresponding periods. They are liable to think that the details are of little value, until their attention is called to some specific instance where a proper knowledge might have enabled them to effect an economy or increase an income that would have been overlooked if net results only were considered.

Even in those cases where this information is obtained and given to the operating force for its guidance, it may be that the method of collating the figures is erroneous, leading to serious misapprehension of the conditions. It is not every bookkeeper who can properly discriminate between expenditures chargeable to operation and those that should be debited to plant or betterment, even when the data comes to him in intelligible shape. Nor is it every board of directors that has the courage to discriminate between operating and capital accounts.

In this is to be found the reason for a limitation of the work of the Street Railway Accountants' Association. However admirable the forms devised by it, accompanied with whatever elaborate instructions, they are practically useless unless the particular office adopting them contains some one who is capable of thoroughly understanding them and of fitting them to the peculiar needs of that specific road. The best laid plans are frequently made valueless when someone besides their author is entrusted with their execution. Many years ago when a military post was being built on the Pacific coast a number of houses for officers' quarters were constructed in the East and shipped to the post, every piece being carefully numbered and full instructions accompanying them. The soldiers had no difficulty in fitting the pieces together by faithfully following directions and the houses soon stood in apparently perfect condition, when it was discovered that they were upside down and so they remain to this day. (This is absolutely true.) Intelligent and scientific work in execution is no less necessary than in the original conception of the plan.

There is no need for the writer to discuss here what a correct system of accounts for electric railways should comprise, as the Street Railway Accountants' Association has covered this ground, and this paper is rather a plea for the correct application of information available to all who are interested in the subject.

The men engaged in the development of a new railway property do not enter upon the work without retaining competent lawyers and engineers and acting upon their advice. In opening and keeping the accounts relating to the enterprise, however, a similar policy is seldom followed, although correct accounting is quite as vital as correct engineering for the permanent financial success of the business.

With the data usually furnished the office, a proper subdivision of the construction account is not possible to the ordinary secretary or bookkeeper who is not trained in the analysis of difficult accounts. When such a person finds that a blanket contract has been made with a steel company for the roofs of the power house and car barn and for a bridge, he finds it easier to give up all attempts at classification and charge the whole contract to construction.

The advantage to be derived from a proper set of accounts covering the construction period of a railway is not only the satisfaction of knowing just how the money has been expended and the opportunity of comparing actual results with the original estimates. When it becomes necessary to make a statement of the cost of the road to prospective purchasers of the bonds the ability to make a full and detailed exhibit of the way the money already invested has been expended will be found to be of inestimable advantage. If a proper record of vouchers has been made the purchasers can easily verify the statement and satisfy themselves as to the real value that is behind the bonds.

In the case of a merger of two or more roads, this detail sometimes becomes very valuable by affording the proof of the actual cost of the road and its consequent right to a proper share in the new combination. While the earning power of each road is usually the governing factor in the merger, there are often occasions when the real value may be made to largely increase the proportionate valuation, if that real value can be shown to be of a permanent character and to be represented by assets that will be intrinsically valuable to the new enterprise.

The fact that a company starts out with such methods is almost a guarantee also that it will continue them in the further management of the property in its operation.

The task of formulating a complete system of accounts is a formidable one, but fortunately it has been in a great measure already done, and the result is available for all who care to make use of it. However, the new company cannot make proper use of the recognized standards in accounting unless properly advised at the outset.

Nearly all large commercial corporations make a point of having their books audited by accountants who are independent of the company and who are preferably men making such work a specialty. While such an independent examination of accounts is primarily intended to safe-guard the interests of stockholders, it is welcomed by the officers responsible for the accounts examined, because if their work is not correct they wish to know it so that necessary corrections may be made; and when correct, the approval of the independent auditor is an endorsement of value.

The independent auditors for the most part belong to a comparatively new profession whose members are specially trained to deal with the scientific aspect of all accounts in the same way that the lawyer is trained to deal with the legal aspect of any business. The qualified accountant has to meet severe requirements before he may style himself "Certified Public Accountant" or use the initials "C. P. A." after his name. Beginning with New York a number of the states have authorized the granting of the degree of "C. P. A." usually by the state university, to those who have shown themselves qualified, by long experience or by passing a severe examination, to handle properly the intricacies of complicated accounts.

A leading lecturer in one of the prominent law schools is in the habit of saying to his classes that the wise client is the one who consults his lawyer before he gets into trouble. It is the good sense of this remark that leads so many houses to permanently retain a legal adviser whose principal service is to warn the client of the possible danger and not to rescue him when the difficulty has been achieved. The writer believes that a similar policy as to taking advice on accounting would rest on an equally firm foundation, and that no accounts should be opened or afterwards carried on except under the supervision of a competent accountant.

The New Time Table of the Illinois Traction System.

The Illinois Traction System has recently issued a new time table which was effective on March 1st and supersedes all previous time tables for limited, local and express cars on the St. Louis & Springfield Ry., the St. Louis & North-Eastern Ry., the Illinois Central Traction Co., the Chicago, Bloomington & Decatur Ry. and the Danville, Urbana & Champaign Ry.

The new time table is in the form of an attractive folder and besides the schedules, contains considerable general information regarding the lines of the system. The folder bears on the outside of the back cover, a map of the system and contains illustrations of the system's power and rolling-stock equipment, including a standard combination car, an engine-driven generator and a turbine generator in use at the Riverton power station, and an electric locomotive. The two illustrations last named were used in connection with an extended description of the Illinois Traction System which appeared in the "Street Railway Review" for February, 1906.

The New Leominster Line of the Worcester Consolidated Railway Co.

It is seldom that a condition arises which makes it necessary for an electric railway company to operate two separate lines between the same two cities in order to handle the through traffic of these cities. Such, however, was the situation that recently confronted the Worcester Consolidated Railway Co., Worcester, Mass. When this company was incorporated, it absorbed, among others, the Worcester & Clinton Street Ry., the Leominster & Clinton Street Ry. and the Fitchburg & Suburban Street Ry., thus forming a continuous route between Worcester and Fitchburg by the way of Clinton and Leominster, a distance of 31 miles. As this line was contstructed entirely on the public highways, the schedule was necessarily slow and the speed limit restricted. It was therefore thought advisable to construct a second and more direct route.

Some time ago, the Worcester Consolidated Railway Co. caused surveys to be made over another route between Worcester and Leominster, secured private right of way and began construction work. The new line is a direct connection between Fitchburg and Worcester, passing through the towns of Summit Station, West Boylston, Sterling Junction, Sterling Center, Pratts Junction and Leominster, and a thickly settled rural district from which it is expected that a good local traffic will be drawn. It also passes near Waushacum Park and a camping ground, which are both popular summer resorts. As is shown in the accompanying map, the old line passes to the east and the new line to the west of the large reservoir from which the water supply of Boston is drawn. By this new route, the distance between Worcester and Leominster is shortened five miles and the running time between Worcester and Fitchburg will be less than one and one-half hours as against two hours by the old line.

The construction work on this new line has been completed with the exception of a short distance at Sterling Junction where a bridge is to be constructed over the Boston & Maine R. R. At Leominster the road joins with the line now in operation between Leominster and Fitchburg. It is expected that cars will be running over the new line at an early date. The entire trackage by both routes between Worcester and Fitchburg is known as the third division of the Worcester Consolidated Railway Co.

Between Worcester and Leominster, there are 10.06 miles of track on private right of way and 5.72 miles constructed on the public highways. The private right of way is 50 ft. wide and the company holds the additional right to slope on adjoining property. The right of way is enclosed by a heavy, woven wire fence strung on cedar posts spaced 20 ft. apart.

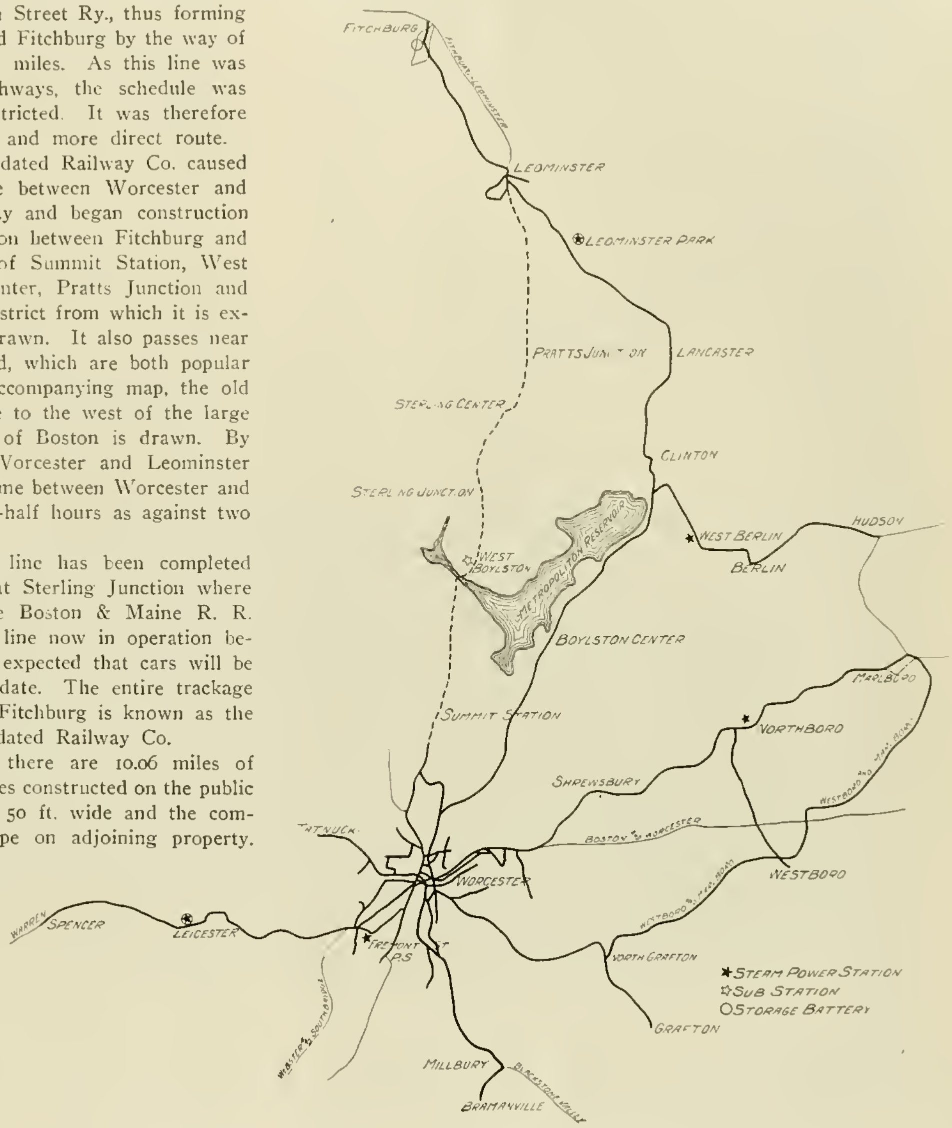
The heaviest cut on the line is 27 ft. and the heaviest fill 20 ft. The total excavation is about 232,000 cu. yds. of which 220,000 cu. yds. were used in fills and in widening the highways along which the line passes. The sides of the cuts and fills have the standard slope of 1½ to 1. The maximum grade is 0.5 per cent for a short distance.

There are 10.35 miles of tangent on the new line, the longest single tangent being 1.36 miles. The total curvature is 28,680 ft., the longest curve being 2,755 ft. with a radius of 5,730 ft. The longest radius is 9,600 ft. which is used on a 1,941-ft. curve. The shortest curve is 66 ft. with a 5,730-ft. radius. The shortest radius used on the private right of way is 1,910 ft. In the streets of the cities and towns, through which the line passes, only four curves have been found necessary.

All of the private right of way between Worcester and Sterling Junction is double-tracked. From Worcester, the first mile of track is laid in the public highway. On this section there are two turnouts. From this point 3,000 ft. of double track have been constructed on a private right of way paralleling the highway after which the road passes on to the highway where single track has been used for a distance of 1,400 ft. From this point there are five miles of double track running alternately on private and public right of way. Between Sterling Junction and Leominster there is a single track with three turnouts placed, one, three and seven miles respectively from the end of the double track.

The track is constructed with standard 75-lb. rail laid in 30 and 33-ft. lengths with the exception of two stretches, 3,000 and 2,000 ft. in length where girder rail in 60-ft. lengths has been used. The specifications call for 18 in. of ballast.

There are in all, 10 bridges on the line. Two of these are over highways, three over farm crossings, one over the Boston & Maine R. R. and four over streams of water. In addition there are two cattle passes and three large culverts which have concrete abutments.



MAP SHOWING LINES OF THE WORCESTER CONSOLIDATED RAILWAY CO.

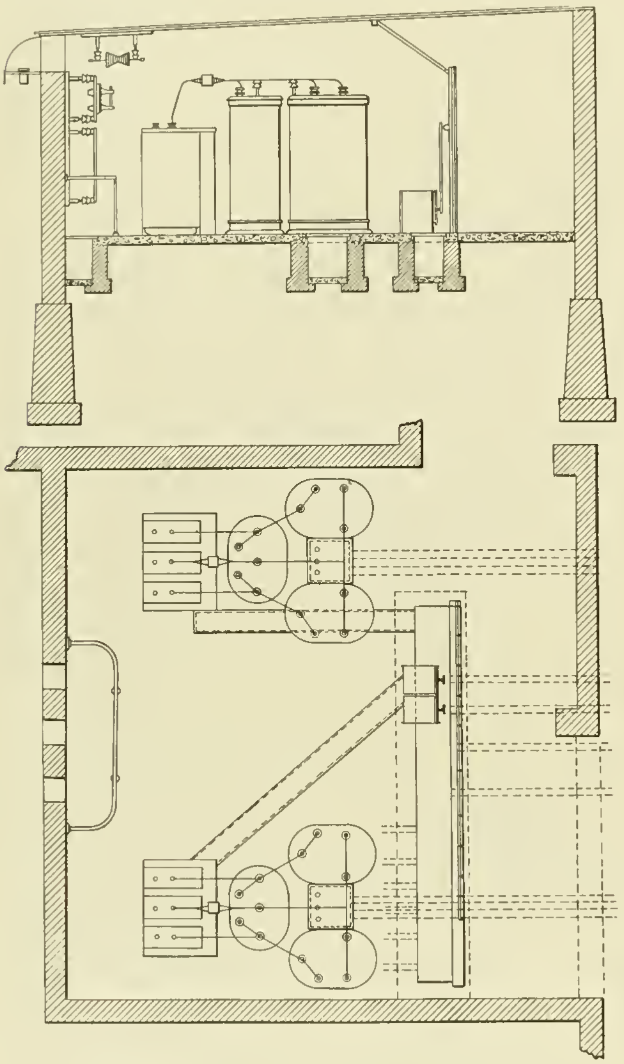
Current for the new line will be carried over transmission lines from the power station located at Leominster Park. This station, which has been in use since the completion of the old road between Worcester and Fitchburg, has been remodeled and additional equipment has been installed to provide for the increased power demand. An addition, 86 x 34 ft. in size, has been built on the west side of the engine room and a new engine and two rotaries will be installed. The boiler room has been enlarged for the accommodation of three extra boilers and a switchboard room has been added to the south side of the structure.

The plant is equipped to use either steam or water power, or both, as occasion may demand. The power equipment consists of two 250-h. p. upright, and three 200-h. p. horizontal boilers which furnish steam at 150-lb. pressure, one 500-h. p. corliss engine, 18 x 34 x 48 in., two 18 x 36-in. Slater high-pressure engines, one pair of 30-in. and two pairs of 27-in. water wheels.

The water wheels are operated during the rainy season with a 19-ft. head of water and at other times they are cut in to relieve the steam installation whenever a sufficient head of water can be

obtained. The power house is located on the banks of the north branch of the Nashua River which has been dammed. While the turbines have proved very successful, the company has not been able to secure enough land to enable it to store a sufficient supply of back-water to keep the wheels in operation at all times of the year.

The turbines are located in the outer walls of the basement, and a shaft leads into the building, connection to the main shaft in the engine room on the ground floor being effected by means of a belt. The wheels are regulated by two governors and controlled by friction clutches. By means of the clutches the turbines may be operated separately or together on one or more of the generators



PLAN AND SECTIONAL ELEVATION OF TRANSFORMER HOUSE AT MAIN POWER STATION.

or they may be operated in conjunction with the engines. The engines and turbines have a combined capacity of about 1,500 h. p.

The electrical equipment consists of two G. E., 150-kw., direct-current generators and two 400-kw. alternating and direct-current machines. These are connected by a belt drive to the main shaft. The distance from the center line of the engine shaft to the center line of the generator shaft is 45 ft.

The main steam pipe which leads from the boiler room to the engines is 10 in. in diameter. This pipe is well insulated and is carried overhead in long, easy curves eliminating all elbow joints. From this main pipe 6-in. feeders extend to the corliss and 5-in. feeders to the other engines.

The main shaft is 5½ in. in diameter and extends along the north side of the engine room. It is belt-driven either by the engines or by the water wheels. The fly wheels of the corliss engines are 20 ft. in diameter and have 45-in. faces. The fly wheels are 16 ft. in diameter and have 45-in. faces.

The feed water is drawn either from a city water main or from the pond formed by the company's dam. The latter is used only in emergency. The feed-water main is three inches in diameter and this is reduced to one and a half inches as it enters the boilers. A Dean pump, 10 x 6 x 12 in. in size, with a 4-in. suction and 3-in. discharge is used for pumping the feed water. The water passes through the main and auxiliary heaters before entering the boilers. Each heater is furnished with a by-pass valve making it possible to regulate the flow. As the plant always has a good supply of water in the pond which can be pumped with a two-foot lift, cooling towers have not been found necessary.

The room in which the switch and transformers are to be placed is 23 x 22 ft. in size. The transformers are arranged in banks of three. By this arrangement the space has been utilized to better advantage and has left room for another installation in case the plant is enlarged. All cables leading from the switch panels are laid in conduits. The switchboard has eight blue-slate panels and is located in front of the transformers and near the engine room proper.

A sub-station is located at West Boylston. This is the only sub-station on this entire system which has more than 142 miles of track. It is a brick structure 30 x 40 ft. in size and a story and a half high. The equipment consists of two 600-volt rotaries and six transformers. The transmission lines from the power station enter the sub-station through the east walls and the current passes through oil switches to the tranformers where the pressure is stepped down from 13,200 to 600 volts and thence into the rotaries and out over the line. One feeder cable leads from the station in each direction. All of the inside cables connecting the switches, transformers and rotaries are laid in conduits. Lightning arresters are provided for the high and low-voltage lines. The switchboard is of the two-panel type and is equipped with all necessary appliances.

The transmission line is 11 miles in length and is located for the greater part on private right of way. It consists of three, No. 4 bare copper wires strung on 35-ft. poles set 100 ft. apart. Porcelain insulators 5½ in. in diameter are used. Where the transmission line is carried on the right of way occupied by the railway the wires are strung 18 in. apart on cross-arms set in the upper gains of the trolley poles. Below the cross-arms carrying the transmission lines an eight-pin arm carries the feed and telepone wires and provision is made for the wires of a signal system which may later be installed.

The power generating and distribution system of the earlier constructed portion of the Worcester Consolidated Railway Co. was described in the "Street Railway Review" for January, 1902. The company was formed in 1901 from a merger of seven companies operating a total of 130 miles of electric railway track in and about the city of Worcester. On Feb. 7, 1906, the extent of the system was further increased by the taking over of the Marlboro & Westboro Street Railway Co's. property. The new acquisition is 13.5 miles in length and operates betwen Marlboro, Westboro and Worcester. The electric express service which the Worcester Consolidated Railway Co. expects to inaugurate over its lines in the near future, will be extended to the new property.

The Massachusetts railroad commissioners have authorized the Old Colony Street Railway Co. to issue four-per-cent, 50-year bonds to the amount of $200,000, the proceeds to be used for refunding and new construction purposes.

The franchises and property of the York (Pa.) Street Railway Co. have been sold to Brown Brothers, bankers, of Philadelphia. It is expected that under the new ownership the trolley system will be extended. Previous to the sale of the road the York County Traction Co. owned and controlled all the lines of street railway in York, together with the suburban lines to Dallastown, Red Lion and Windsor, a distance of 11 miles; the York and Dover Electric Ry., which passes through the company's Brookside Park; the York Haven Street Ry., running to the town of York Haven, a distance of 11 miles, and the York and Wrightsville Street Ry., connecting Wrightsville, on the Susquehanna River, with York, a distance of 12 miles. The entire system has 56 miles of well constructed tracks. In addition to the railway lines, the York County Traction Co. owns the Edison Electric Light Co., the Westinghouse Electric Light Co. and the York Steam Heating Co.

Notes on the Electrical Equipment of the Simplon Tunnel.

BY FRANZ KOESTER.

The immense undertaking of constructing the Simplon tunnel, which has been under way for several years and lately completed, has now progressed to the point where the electrical equipment of the road is under way, and it is now only a question of a few months until the road will be formally opened to the traveling public.

The question of whether or not the Simplon Tunnel Ry. should be electrically equipped, has, for a long time, been under consideration by the engineers. At first the advantages to be gained by electrical operation were not considered great enough to warrant its adoption on such an important international line, but as the question of ventilating the tunnel became such a serious one should steam power be used, and other standard gage roads commenced to adopt electricity as the motive power, the engineers became convinced that it was the more suitable in this case.

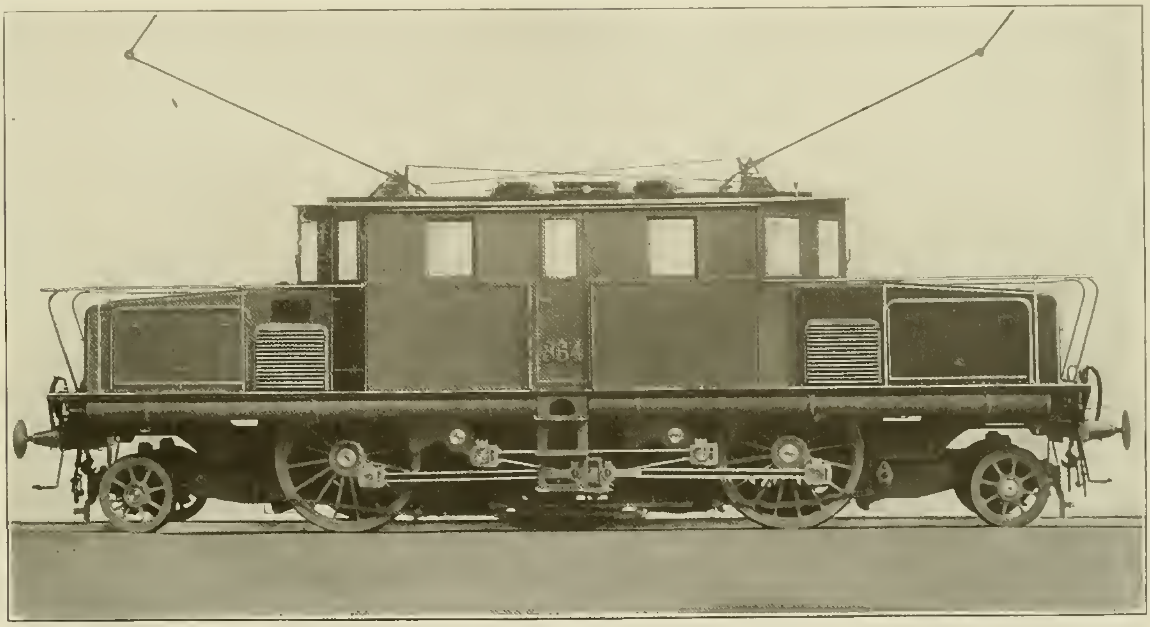
The firm of Brown, Boveri & Co. of Baden, Switzerland, offered to have the entire electrical plant ready by the date of the opening of the tunnel and to put this installation at the disposal of the Swiss Federal railways in order that a comparison between steam and electrical traction could be made on a large scale and on a line which is especially suited to show the special advantages of electric traction. As only a limited time is left before the opening of the tunnel, which is fixed for the early summer, certain contemplated technical arrangements had, on account of this short time, to be modified. It was quite impossible in the short time to construct entirely new locomotives, so the existing material will be used. The earlier mentioned manufacturing firm was, at the time, building two three-phase locomotives of 900 and 1,000 h. p. each for the Italian State railways and as there was a possibility of transferring these to the Simplon tunnel line, by the consent of the authorities of the Italian State railways, the three-phase system was decided upon.

Many existing systems illustrate that three-phase operation is perfectly feasible for electric traction especially on standard gage roads. If, therefore, in the first instance, the choice of the three-phase system for the Simplon railway was due to circumstances, it is also justified by its proven excellence under similar conditions.

The basis on which the system is to be installed is as follows: At each end of the tunnel, which is about 12 miles long, there are hydraulic power plants which have, up to the present time, been used to supply power to the very extensive construction plants used in building the tunnel. With a few alterations and enlargements it will be possible to use this generating equipment, which is entirely furnished and ready for use, for the generation of the current for the electric traction. In the stations both at Brigue and Gelle, three-phase current at a voltage of 3,300 volts and a frequency of 15 cycles per second will be generated.

Only the length of the tunnel, which is between Brigue and Gelle, is to be operated by electric traction. The other portion of the road is not to be electrified. This distance of 12 miles is so short that current will be conducted at the generator pressure without being transformed directly to the trolley line which passes through the tunnel. This trolley will be suspended in the tunnel itself on transverse suspension wires fixed on hooks cemented into the walls. The trolley will be of the two-wire type and the return current will pass through the rails. The span wires are to be located about 25 meters (80 ft.) apart. It did not seem necessary to choose a shorter distance owing to the fairly even temperature in the tunnel which prevents any considerable difference in the sag of the trolley suspension wires, the trolley pole being so constructed that no matter how much sag there is in the wires, it would be impossible for the trolley pole to fly off the wires. All bonding of rails will be done with plastic bonds.

There will be a train switching station in the center of the tunnel which will be made use of when trains, owing to delay, should have to pass to overtake other trains. For ordinary service, no passing of trains is supposed to take place. The siding will also be electrically equipped and switches will be placed at its ends allowing the two halves of the trolley line to be separated.



THREE-PHASE LOCOMOTIVE FOR THE SIMPLON TUNNEL.

The organization of traffic has been so planned that at the arrival of a train from Lausanne at the Brigue station the steam locomotive will be taken off and an electric one put onto the train after which the train will be electrically driven as far as Gelle where a steam locomotive will again take the place of the electric one.

At the stations iron trolley poles will be used and the trolley lines will, as in the tunnel, be attached to span wires. At Gelle, where several tracks will have to be spanned without any intermediate supports, the catenary system which has been used in the different countries of Europe and also in America will be employed. The strain on the poles in this system is reduced to a minimum.

The locomotives have three driving and two pilot axles, the former being connected with two motors which are located between the drivers by means of connecting rods which are well balanced by four counter weights two on each side of the frame. The motors are designed for two speeds, 30 and 40 miles per hour, the draw-bar pull of the locomotive at the lower speed amounting to six tons and at the higher speed 3.5 tons. The total weight of the locomotive is 62 tons and the weight on the driving wheels is 42 tons. The cab is provided with four doors, two at the side

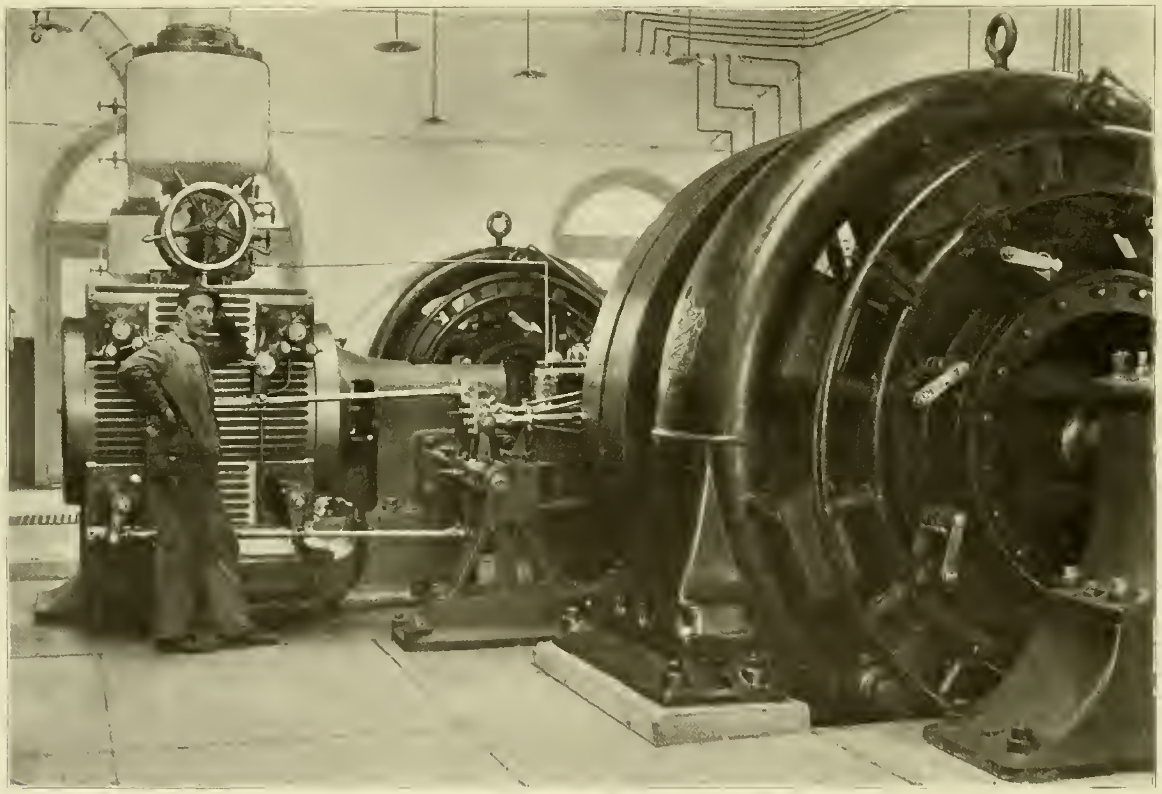
and two at the ends, the latter for allowing access into the first car of the train. All the electrical equipment is located in the cab with the exception of the rheostats which are placed in the boxes on the front and end of the locomotive.

It may be seen in the accompanying illustration that the trolley-pole system is so designed as to allow the locomotive to move in either direction without changing the position of the trolley pole. On the section which is to be first equipped, there are grades up to 10 per cent for very short distances. The up grade on the north side from Brigue to the center of the tunnel amounts to seven per cent. It will be necessary to run passenger trains having a gross weight 365 long tons and freight trains weighing 465 long tons.

The time occupied by the passenger trains from Brigue to Gelle will be 20 minutes and in the opposite direction 30 minutes. The freight trains will take about 40 minutes in each direction.

The Walkill Transit Ry.

The Walkill Transit Ry., Middletown, N. Y., is now receiving considerable attention from its owners with the ultimate object of placing it among the leading small properties of its state. This railway was built in 1893, and owing to many reverses passed into the hands of a receiver and was allowed to deteriorate. Early in 1905 the property was taken over by Harrisburg and Philadelphia interests and since many needed improvements have been made.



GENERATING UNIT IN POWER HOUSE.—WALKILL TRANSIT RY

The line is 12.70 miles in length and connects Middletown and Goshen, two thriving cities in the southeastern part of the state of New York, also serving a thickly settled rural community.

A new power plant, located one mile east of Middletown, has been completed. It is of red brick and concrete construction with a floor area of 60 x 75 ft. Steel angle trusses and girders are used in the roof construction, over which corrugated iron in 2½ x 6-ft. strips is laid with overlapping ends and edges. A cupola about four feet high occupies the center of the roof. This is constructed with ventilator sides giving the building a good circulation of air and good light from overhead. The station was designed for three units, but for the present only two have been installed.

The building is heated throughout by steam. The new barns located about 100 ft. from the station are also heated by steam conducted from the power house in underground piping. Soon after the present owners of the Walkill Transit property came into control the old power house and barns, which were located in the northern part of Middletown, were condemned and as soon as the new plant was completed the old electrical equipment was scrapped and sold.

The engine room is 30 x 60 ft. in floor area. The floors are built up to a height of five feet on concrete to give a good foundation for the engines and generators. The equipment consists of two Fleming four-valve engines of 510 and 315 h. p. capacity which are direct connected to two Bullock railway generators.

The boiler room has a floor space of 45 x 60 ft. in which a battery of three Franklin water tube boilers of 250 h. p. each is installed. The boilers are worked under a steam pressure of 150 lb. About six feet of space is left between the rear of the boilers and the brick wall, dividing the engine and boiler rooms, for a passage-way behind the boilers. This also gives ample room for the header and other steam piping. The live steam main is 12 in. in diameter and is carried overhead from the boilers directly into the engine room. Between the main header and the feed water heater a Bundy automatic trap takes care of the drips, returning them directly to the heater.

The open type heater is supplied with heat by the exhaust steam and delivers the water to the boilers at 220° F. The water is furnished to the boiler plant by direct connection to a city water main. Arrangements have been made for a second pipe to deliver the water through a four-inch main to the boilers, without passing through the heater. Two Worthington pumps are used.

The stack, constructed of ¼-in. sheet steel, is 150 ft. high, 7 ft. in diameter at the top and has a 9-ft. conical shaped base. The stack stands on a concrete foundation 12 x 12 ft. in area and is self sustaining, no guy wires being used for its support. The breeching leading from the boilers to the stack is 8 x 3½ ft. in section. This joins the stack about 15 ft. above the ground. No special provision has been made for handling the coal supply, it now being the custom to deliver the coal to the doors of the boiler room in cars over a switch from the main line of the Ontario & Western Ry. which runs within a few feet of the plant.

The switchboard is located in one corner of the engine room. The switchboard is of the six-panel type and is equipped with all the modern appliances. The cables from the generators to the switchboard and from the switchboard to the north walls, where

the feed wires pass out of the building, are laid in underground conduits. Four No. 0000 insulated wires feed the trolley. One of these feeds direct, one is carried to Middletown where it aids in keeping up the pressure for the operation of the city cars, and the other two tap into the trolley wire on the Goshen division.

A new car house 160 x 55 ft. in floor area has also been constructed on property adjoining the power plant, the general scheme of the company being to concentrate the various buildings into one group and thereby curtail the expense of operation. The frame of the building is composed of 4 x 6 and 6 x 6-in. timbers which are supported on concrete foundations. The roof is constructed of angle iron trusses and 1½-in. white pine boards with an asphalt composition finish. The outside of the building is finished with novelty siding which is painted. The inside walls are finished with a corrugated iron lining.

EXTERIOR OF CAR HOUSE AND REPAIR SHOP.

Though the upper part of this structure is of a temporary type of construction, the pits and other lower portions are permanent. The principal feature of the building is the amount of space given over to the pits. These are of standard construction and extend the full length of the building under two of the three tracks and for 100 ft. under the third track. This feature was given a good deal of attention with the idea of using the building exclusively for repair work when another barn which is now under contemplation, is constructed. The building is divided into a car storage house 105 ft. long, a repair shop 36 x 55 ft. and a paint shop 16 x 55 ft. A stock room 14 x 14 ft. has been built in one corner of the shop. The company does its own repair work and expects soon to do all of the necessary field and armature coil winding.

A 30-minute schedule is now maintained between the two terminal cities and in Middletown, where the line serves the principal streets, a 15-minute headway has been inaugurated. Several new 36-ft. Brill cars equipped with four Westinghouse 101-B motors, have been added to the equipment and special attention has been given to the re-alignment of the track and overhead construction.

A superintendent's office and waiting room has been fitted up on the ground floor of a building centrally located in Middletown. All city and interurban cars stop at the station before departing on their runs and each conductor acts as his own starter by stepping to the station door and calling out the destination of his car. A small room at the rear of the building serves as the trainmen's quarters. In this room an assignment board designed by the general manager, which gives the motormen and conductors all desired information for the following day's operations, has been installed.

The Walkill company operates Shohola Park which is located midway between Middletown and Goshen. This park is now being remodeled and provided with many new amusement devices. An agreement has recently been entered into between the Walkill Transit Ry. and the Erie R. R. whereby many summer excursions given over the latter company's lines this year are to be at Shohola Park. By this agreement the excursionists will leave the steam road at Goshen and be transferred to the park by the electric cars. Special rolling stock is to be provided by the electric company for properly handling the crowds. The park contains about 30 acres of land.

The officers of the company are: President, E. R. Spousler, Harrisburg, Pa.; vice-president, W. H. Royce, Middletown, N. Y.; treasurer, W. M. Ogelsby, Harrisburg; general manager, E. C. Folsom, Pleasantville, N. J.; superintendent, H. S. Miller.

Lake Michigan Park.

The Muskegon Lighting & Traction Co.

The Muskegon Lighting & Traction Co. operates a park which is known as Lake Michigan Park, and is sometimes referred to as "The Atlantic City of the West." This park is located on Lake Michigan about five miles from the center of the city of Muskegon. In general the park is operated by the company and is managed by E. R. Reed. The dining hall and bathing pavilion concessions are leased.

The park contains a good theater in which refined vaudeville is presented every afternoon and evening during the season. The theater has a seating capacity of 800. A small admission is charged to the theater which is run for 15 weeks during the summer season. There is also a well-equipped dancing pavilion with a capacity of 500 people. Admission to the grounds and dancing pavilion is free. The park is operated entirely for the purpose of stimulating travel on the electric line.

Through the efforts of General Manager George W. Knox of the Green Bay Traction Co., a new combination time table has been prepared and is soon to be issued for all of the interurban electric lines in the Fox River valley, from Green Bay to Fond du Lac. The time table will be published in the form of a pocket folder, as well as in the form of a wall card and will be generously distributed.

An Interesting Bit of Boston History.

BY H. S. KNOWLTON.

Recent developments in the application of electricity to steam railroad service have been of such absorbing interest that the steady progress which is being made in the field of urban rapid transit has to some extent been overlooked. We are so accustomed to the trolley car, subway and elevated system, that it is easy to forget what a short life the electric railway industry has thus far experienced. The last 50 years have witnessed the growth of over 200,000 miles of steam railroad lines in this country alone. Half a century ago, to take the experience of Boston as illustrative, all the passenger traffic of the New England metropolis was handled by the cab and the omnibus. Today we can scarcely realize that within five years of the outbreak of the civil war even the horse car was unknown in the Hub, but when we recall the fact that the first electric car operated in Boston began to do business only 17 years ago, the remarkable growth which has since taken place in that city is brought home to us with all the force of a revelation.

Rapid transit history has been made swiftly in Boston. Only eight years after the first trolley car was placed upon the streets the Tremont St. subway was opened for traffic. The narrow crooked streets for which the city proper is justly famous, throttled down the movement of vehicular traffic of all kinds to a degree which became intolerable. Before the Tremont St. subway was opened for business it often required as much time to ride a mile and a half through the congested district as to traverse 25 miles upon a suburban or through train on any of the steam railroads radiating from the city. The Tremont St. subway was the first city underground line in the United States, and it served its purpose well; its usefulness is unquestioned today, but from the operating standpoint it is unsuited to the economical movement of electric trains. The curvature and grades are excessive and the resulting wear and tear upon the rolling stock is very great. No train can be operated down an eight per cent grade with a sharp reverse curve and an ascending grade at the bottom, all of which conditions are simultaneously present here in a single train length, without being subject to the strains and wear which such a corkscrew-like route imposes; reverse curves of 82 and 90-ft. radius are troublesome to negotiate, even with motors on every car, and long ascending grades of five per cent or 264 ft. per mile, are not calculated to reduce the power station demands of trains requiring about 300 kw. per car during acceleration.

The rapid progress of urban transportation is still more apparent when one appreciates that only four years after the Tremont St. subway was opened, the present elevated system in Boston began to carry passengers. The contrast between the equipment of the Boston Elevated Railway Co's. elevated division and the rolling stock first propelled by electricity only 12 years before, is wonderful. During that time the value of the single reduction gear and the carbon brush became well established, the capacity of motors increased ten-fold, the carrying capacity and substantial construction of cars were augmented and improved, the excellent principle of the multiple-unit system of control was developed, air-brake equipment was adapted to the strenuous requirements of frequent stops and higher speeds, and power stations became huge industrial units whose individual machines often doubled or tripled the capacity of the entire station of an earlier day. In proportion to its weight, the modern elevated cars became the most powerful vehicle on rails, and the end is still far from the horizon.

The saving of time which the inauguration of the rapid transit lines in Boston has accomplished is almost beyond calculation. Time is more valuable in these days than ever before. Before the Boston Elevated began operation, a passenger who covered the five miles between Dudley St., Roxbury, and Sullivan Sq., Charlestown, in 45 or 50 minutes, considered himself fortunate. The elevated system has more than cut in two the duration of this journey. To pass by surface car and ferry from Scolley Sq. to Haverich Sq., East Boston, in less than 25 minutes, was good work before the tunnel under the harbor was opened. The air line distance cannot greatly exceed a mile and a quarter, and the tunnel cars make the trip in about seven minutes. Even the professional statistician can scarcely give us an accurate estimate of the financial value of such a saving, in a year's time. The new rapid transit line to Harvard Sq., Cambridge, will probably, when completed, cut down the time en route between that point and Tremont St., Boston, by two-thirds, making a saving of perhaps half an hour a day per passenger round trip. The progressing extension of the elevated structure nearly three miles southward from Dudley St. to Forest Hills, will bring still another great section of the city in close touch with the business district. The completion of the Washington St. tunnel will result in lessened surface congestion, and will be the signal for the restoration of the Tremont St. subway to the uses of surface cars. The curves and grades of the Washington St. line are vastly more favorable for rapid transit train service than the physical characteristics of the existing subway. The largest train at present operated on the elevated system is made up of but five cars, giving a one-way traffic capacity per hour of 30,000 passengers on a 90-second interval, allowing 150 passengers per car. On this basis the Washington St. tunnel eight-car trains could handle nearly 50,000 people per hour in each direction, given the proper conditions at station platforms, entrances and exits.

The evolution of rapid transit in Boston has at times proceeded with dramatic speed. A triumph of engineering organization was scored in the 36 hours before the road was opened for traffic. In that time, the subway platforms were changed by 1,200 men to fit train service rather than surface car operation, 23 free transfer points were established, 2,500 conductors were instructed in the working of the new system, and the routes of over 50 lines of surface cars were changed. Probably half the passengers who used the old system were diverted from their usual routes, the equipment and trainmen were new to their work and few of the patrons of the road had ever ridden in an elevated train. All this is a matter of street railway history, but it is worth recalling as the first five years of elevated operation in Boston draw to a close. The success which the system enjoyed from the start in the matter of handling its heavy traffic without accidents was little short of remarkable, considering the revolutionary character of the change.

Within these five years many improvements have been made with a view toward rendering the service safer, quicker and more economical from the operating standpoint. A more rugged and less complicated form of multiple-unit control has been adopted on the later cars; the side and vestibule doors have been altered to be operated by compressed air instead of by platform men, with the added safety feature that the closing of the last door gives the starting signal in the motorman's cab; new cars have been designed with special reference to ease of access and the operation of the trains has been made smoother. In the power stations, the economy of generation has received constant attention and the company has purchased additional units to meet the increasing demands of the entire system. A radical departure from the former practice is the selection of a direct current turbo-generator for one plant and the choice of direct-connected gas engine units for two new stations in the residence districts. Manganese steel rails have been introduced on the sharpest curves and the life anticipated is over 60 times that of an ordinary high carbon steel rail.

The surface car system is also undergoing important developments. The wasteful operation of single motors with rheostatic control on open cars has been replaced by series-parallel two-motor equipment; electric track switches have been installed at many junction points; experiments are being made with trailers on certain parts of the surface system, and semi-convertible cars have been adopted for tunnel and other service. A notable improvement in rolling stock is exemplified by the design of a car for tunnel service which is fitted with folding steps, the object being to eliminate the usual accidents to passengers entering or leaving while the car is in motion. No passengers can board or leave the car until the steps are lowered.

The development of the Boston system is representative of many changes in other great cities, but perhaps in no other American city are the conditions more complex and varied. The progress outlined in the foregoing comments typifies the energetic development of urban rapid transit as a whole, and the problems now in process of solution in Boston cannot fail to be of interest, not only to the street railway specialist, but to the general student of engineering.

The Milwaukee Electric Railway & Light Co. has adopted the single-phase system for the extension of one of its long interurban lines.

Recent Street Railway Decisions.

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[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Kenfield Publishing Co. under the title "Street Railway Law," five volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901 to 1903; Vol. V. from April, 1903, to August, 1905. Price: Bound in sheep; five volumes, $12.00; single volume, $3.00. Bound in buckram; five volumes, $8.00; single volume, $2.00.]

RIGHT TO RUN FREIGHT CARS CANNOT BE QUESTIONED COLLATERALLY IN PERSONAL INJURY CASE—LEGISLATURE MAY LIMIT AUTHORITY OF CITY OVER STREETS.

Roberts vs. Terre Haute Electric Co. (Ind. App.), 76 N. E. Rep. 323. Dec. 5, 1905.

The plaintiff argued that the using of interurban freight cars and the carrying of freight thereon over the lines of interurban street railways, without the consent of the proper city authorities, was a wrong done to the general public; and that a wrong done to the general public, that resulted in a special injury to a particular citizen, gave to the injured party a good cause of action for damages. But the appellate court of Indiana, division No. 2, says that the complaint did not allege that the defendant was not complying with the Indiana acts of 1901, but that the carrying of freight was done without the consent of the authorities of the town. The right of the defendant to run freight cars over its lines could not be questioned in this collateral way. It says, too, that the legislature may limit and restrict the authority a city has over its streets.

A RAILROAD COMPANY CANNOT CONDEMN LAND FOR A PARK—PUBLIC USE.

Great Falls Power Co. vs. Great Falls & Old Dominion Railroad Co. (Va.), 52 S. E. Rep. 172. Sep. 14, 1905.

This proceeding was inaugurated, under section 52 of the Virginia act concerning corporations, to obtain from the state corporation commission a certificate, in accordance with the provisions of that section, authorizing the railroad company to condemn, principally for a park, land belonging to the power company shown to be "very rough and rugged—rocky; about as wild a piece of property as there is anywhere in the state of Virginia." Section 52 provides: "No corporation shall take by condemnation proceedings any property belonging to any other corporation possessing the power of eminent domain, unless after hearing all parties in interest, the state corporation commission shall certify that a public necessity or that an essential public convenience shall so require, and shall give its permission thereto; and in no event shall one corporation take by condemnation proceedings any property owned by and essential to the purposes of another corporation possessing the power of eminent domain." The commission granted the application, but its order is reversed by the supreme court of appeals of Virginia.

Prior to the present law, under which this proceeding was taken, the land of the power company, the court states, could not have been condemned by the railroad company, because it had no legislative permission to take the property of another corporation. The right, therefore, of one corporation to condemn property already devoted to the public use by another, should not be extended by construction beyond the explicit requirements of the statute giving that power.

Now, it clearly appeared, the court says, that the land in question was sought by the railroad company as a terminal point on account of the rare scenic features it afforded, and because of the attractions it would hold out to pleasure seekers from the city of Washington. In other respects the location possessed none of the advantages ordinarily accruing to a railroad, and but for the beauty of the scene would most likely have been avoided as offering no inducements to such an enterprise. It was further clear from the record that the quantity of land sought to be condemned was far beyond any necessity for mere terminal purposes of an electric railway extending a distance of 14 miles from the city of Washington. It was manifest from the evidence that the location was selected with no reference to the public use of the road in the matter of freight or the accommodation of the traveling public along the route, but that the real purpose of the condemnation was to establish a park overlooking the Great Falls of the Potomac, for the comfort and pleasure of sight-seers and curiosity seekers, and to thereby add to the revenues of the railroad company by making the point an attractive place of resort.

To justify the corporation commission in taking the action here complained of, it must not only appear that the land sought to be condemned was for public use, but it must affirmatively appear that a public necessity or an essential public convenience required that the land of the power company should be taken. What is a public use is said to be incapable of exact definition; that it is easier to define by negation than by affirmation. Whatever rule may be formulated on the subject as a result of the adjudged cases, it cannot, the court thinks, include the condemnation here sought as one made for a public use. Looking to the charter of the railroad company, it was to be seen that it was organized for "public use" in transporting persons and property along its line; in other words, had undertaken an ordinary railroad enterprise. The ground upon which private property may be taken for railroad uses without the consent of the owner is primarily that railroads are highways furnishing means of communication between different points and promoting traffic and commerce. The taking of property for these purposes must always be limited to the lawful necessities of the enterprise. The moment the appropriation goes beyond such necessity, it ceases to be justified on the principles which underlie the right of eminent domain. The charter of the railroad company furnished no warrant for condemning property for the purpose indicated by the record. It was doubtless an attractive point, on account of its inspiring scenery, for the location of a park, and such a terminal would very probably increase the revenues of the railroad company; but to gratify the senses of the pleasure seeker and thereby incidentally to increase revenues is without the domain of a public use for which private property may be taken under the power of eminent domain.

Furthermore, the power company being a corporation with the power of eminent domain, its land could not be condemned by another corporation possessing that power, unless the public use sought to be made of it reached the measure of a public necessity or an essential public convenience, this being the express mandate of the statute under which this proceeding was had, and without which the application of the railroad company could not be entertained.

BURDEN OF PROOF AND PRESUMPTION IN CASE OF DERAILMENT—NOT AN INSURER—CARE REQUIRED.

Omaha Street Railway Co. vs. Boesen (Neb.), 105 N. W. Rep. 303 Oct. 19, 1905.

In an action against a street railway company for damages for injuries sustained by one of its passengers, the burden of proof on the question of negligence, the supreme court of Nebraska holds, does not shift to the defendant upon proof that the injuries resulted from a derailment of the car. In such case a presumption of negligence arises from the fact of derailment; but, when that presumption is met by evidence which makes it equally probable that the accident was not due to negligence on the part of the defendant, in the absence of other evidence tending to establish the affirmative of the issue, the defendant is entitled to a verdict. A street railway company is not an insurer of its passengers. It is not bound to do everything that can be done to insure their safety. It fulfills

its obligations in that regard when it exercises the utmost skill, diligence, and foresight consistent with the practical conduct of the business in which it is engaged.

CONDUCTOR REQUIRED TO USE "REASONABLE CARE" ONLY TO ASCERTAIN IF PASSENGERS DESIRE TO GET ON OR OFF CAR STOPPED AT RAILROAD CROSSING—"REASONABLE CARE" DEFINED.

Raymond vs. Portland Railroad Co. (Me.), 62 Atl. Rep. 602. Dec. 6, 1905.

An instruction told the jury that if they believed that under the practice and custom of the company the cars stopped at a certain railroad crossing and that people got on and off there while the cars were stopped, then it was the duty of the conductor in charge of the open car on which the plaintiff was a passenger to ascertain for himself whether passengers wanted to get on or off, and that "if he could by great care discover who wanted to get off, whether they wanted to get off, that would be equivalent to actual knowledge on the subject." The supreme judicial court of Maine criticises this for the employment of the term "great care," holding that exceptions to the instruction must be sustained. It says that the law requires that the conductor should have acted only in the exercise of reasonable care. "Reasonable care" may be defined as such care as an ordinarily reasonable and prudent person exercises with respect to his own affairs, under like circumstances.

RISK ASSUMED BY PASSENGER RIDING ON RUNNING BOARD—CONTRIBUTORY NEGLIGENCE.

Burns vs. Johnstown Passenger Railway Co. (Pa.), 62 Atl. Rep. 564. Jan. 2, 1906.

The supreme court of Pennsylvania says that it has frequently said that the running board of a car is not intended for the use of passengers, except as a convenience in getting in and out of the car. A passenger who stands on the running board when there is room inside, or when it is reasonably practicable to go inside the car, assumes the risk of his position. It follows, therefore, that a passenger who is injured while standing on the running board must show by affirmative testimony that it was not practicable for him to go inside the car before he can sustain an action for damages. In addition to this, where a passenger placed himself on the running board and knew of the close proximity of the poles to the tracks and the danger therefrom and could have avoided the latter by reasonable care, the court holds that it was his duty to do so, and, having failed to perform his duty in this respect, he was guilty of contributory negligence, and there could be no recovery of damages.

RELATION OF PASSENGER AND CARRIER CONTRACTUAL—DOES NOT ARISE FROM ONE RUNNING TOWARD MOVING CAR—MAY BE PROVED BY CIRCUMSTANCES.

Chicago Union Traction Co. vs. O'Brien (Ill.), 76 N. E. Rep. 341. Dec. 20, 1905.

The relation of passenger and carrier, the supreme court of Illinois holds, is contractual, and does not arise out of the fact that a person runs toward a moving car to get on board, but the relation may be proved by circumstances.

PRESUMPTION FROM BLOWING OR BURNING OUT OF CONTROLLER.

Firebaugh vs. Seattle Electric Co. (Wash.), 82 Pac. Rep. 995. Dec. 11, 1905.

An instruction was given the jury in this case that, "When a controller upon a car of a street railway company blows out or burns out, the law presumes that such blowing or burning resulted from some defect of the controller or other appliances of the car, or means used by the company in the operation of the car, and in such a case it devolves upon the company to show that such burning or blowing out did not result from any cause which the highest degree of care on its part could have prevented." The supreme court of Washington holds that this was not error.

REASONABLENESS OF RULE REQUIRING USER OF TRANSFER TO TAKE CAR AT INTERSECTION OF ISSUING LINE—WALKING A BLOCK WHILE WAITING FOR CAR.

Hanley vs. Brooklyn Heights Railroad Co. (N. Y. Sup.), 96 N. Y. Supp. 249. Dec. 8, 1905.

Two women, the plaintiff and a companion, having transfer tickets waited five or ten minutes at the street intersection to take a car, then left the place of intersection and walked a block along the street 600 or 800 ft. long, and boarded a car. They offered the transfer tickets to the conductor, a dispute arose, and it was testified that an assault and attempted ejection followed. The tickets read: "Good only for the day printed hereon, within the time limit punched and at intersection of issuing line." The second appellate division of the supreme court of New York says that the reasonableness of the rule was a question of law, and that the rule was in this case held reasonable. But there was error in the submission of the question of substantial violation in the face of the undisputed fact that the plaintiff boarded the car at a point substantially distant from the intersection. The lower court seemed to think that because the plaintiff testified that she first waited at the intersection between five and ten minutes for a car, when none came, that she was just convalescent, and that the day was windy and chilly, the jury might find that she did not violate the rule because she walked on the street of intersection and boarded a car at the distance of a block therefrom. If this theory be correct, then the rule could be practically nullified; for if the passenger, for personal and peculiar reasons, could violate the rule and yet resist the enforcement to the point of force, and recover damages for such enforcement if his reasons seemed well founded to a jury, the defendant would not dare to enforce the rule at such peril. If the wind blew sharper at the intersection than elsewhere, if the passenger could gain a few moments' time by walking on to meet the car, if he objected to loungers or other wayfarers at the intersection, if he was too lightly clad to stand at gaze, and other circumstances might seem to the passenger, and possibly to the jury, good excuse for setting the rule at naught. These may be extreme examples, but it cannot be said how far the peculiarities or idiosyncrasies of the individual might go. Certainly the conductor could not well receive dispensing power. He could not conduct his car, and also take the evidence of any passenger who boarded it at places distant from the point of intersection to determine whether he should or should not enforce the rule in each specific instance of its actual violation.

CONSTRUCTION OF GRANT TO BUILD AND OPERATE A SINGLE OR DOUBLE-TRACK ROAD.

Eastern Wisconsin Railway & Light Co. vs. Winnebago Traction Co. (Wis.), 105 N. W. Rep. 571. Nov. 14, 1905.

The supreme court of Wisconsin says that the defendant acquired, by the ordinances under which it operated, the right to build and maintain "a single or double-track railway with all necessary switches and turnouts" upon certain streets, provided that the entire line should be completed and in operation on or before a certain date. The question presented was simply as to the proper construction of this grant. Should it be construed as granting to the defendant the right to build within a certain time either a single-track railroad or a double-track railroad, or should it be construed as granting the right to build a single-track railroad within the prescribed time, and to lay additional tracks at any place and at any time in the future and thus convert it wholly or partially into a double-track road as it might choose? In other words, was the right an option which must be acted upon within a certain time, and which was exhausted when acted upon; or was it a continuing privilege to lay either single or double tracks at any time within the life of the franchise? This was purely a question of the proper and reasonable construction of the language used, and there was little in the way of authority which threw any light on the subject.

That a single-track railroad and a double-track railroad are entirely different things the court says was made clear by certain affidavits used, and is doubtless a matter of common knowledge. That the defendant's road was a single-track road was equally clear. It had turnouts and switches, some of them 500 to 600 ft. long, and one, crossing a bridge, over 1,000 ft. long; but it clearly appeared

that they were nothing more than switches or turnouts, which, of course, were absolutely necessary in the operation of a single-track road. If the grant was the grant of an option to build one or the other, it was certain that the company exercised its right of choice. Looking at the language used fairly and reasonably it seems to the court quite clear that it was an option. A right to do either one of two different things within a certain time is a right to do one thing, not two. Here the right was to build and operate "a single or double-track street railway," provided it was built and in operation on or before a certain time. A single-track railway was built and in operation within that time. One alternative was accepted, and the other was rejected and necessarily lapsed, because both were not offered.

CONSENT OF PROPERTY HOLDER CANNOT BE LIMITED TO PARTICULAR CORPORATION OR INDIVIDUAL—LIMITED CONSENT ONE FOR CONSTRUCTION BY LOWEST BIDDER.

Forest City Railway Co. vs. Day (Ohio), 76 N. E. Rep. 396. Nov. 28, 1905.

The supreme court of Ohio holds that the requirements of section 30 of the new municipal code that the council of a city shall not grant a franchise for the construction of a street railroad excepting "to the corporation, individual or individuals, that will agree to carry passengers upon such proposed railroad at the lowest rates of fare, and shall have previously obtained the written consent of a majority of the property holders upon each street or part thereof, on the line of the proposed street railroad, represented by the feet front of the property abutting on the several streets along which such road is proposed to be constructed," confers upon such property holder the privilege of giving or withholding his consent to the construction of such road, but it does not give him the privilege of limiting his consent to a particular corporation or individual. His consent, so limited, is inconsistent with the requirement that the franchise be given to the corporation or individual that will carry passengers at the lowest rates of fare and would tend to defeat the purpose of the statute. The limitation, therefore, is void, and the consent good as a consent to the construction of the road by the lowest bidder.

DUTY TO SAFEGUARD EXCAVATIONS IN STREET—ADMISSIBILITY IN EVIDENCE OF ORDINANCE—WHEN PORTION OF STREET IS "OCCUPIED"—CITY ENGINEER LOOKING AFTER WORK NO DEFENSE—DUTY OF PEDESTRIAN.

Montgomery Street Railway Co. vs. Smith (Ala.), 39 So. Rep. 757. Dec 21, 1905.

With reference to the liability of a street railway company for injuries received by a party in falling into an excavation made in a street in the work of changing the company's tracks, the supreme court of Alabama holds that the fact that the city required the company to keep the street in repair did not make it any the less liable for negligence in leaving an excavation without the usual safeguards. It also holds that there was no error in admitting in evidence the city ordinance which required any street railway company, operating any line of street railway within the corporate limits of the city or within the police jurisdiction thereof, to make said track conform to the grade of the streets where laid, and to keep in good repair all that part of the street occupied by said rails and tracks and for two feet on either side of said track. It says that it cannot be said that this ordinance related only to the tracks already laid and being operated, and not to additional tracks to be laid. Whenever the street car company took possession of that portion of the street for the purpose of laying a track, it was "occupied by it"; and, even if so strict a construction as contended for could be adopted, the evidence in this case showed that the cross-ties and tracks were laid at the point where the complainant fell, and, irrespective of the ordinance, when a street railway company takes possession of a portion of the street for the purpose of building and operating a railway under a franchise, it necessarily assumes the duty to the public to keep that part of the street occupied by it free from pitfalls, in such condition as not to be dangerous to the traveling public. The court also holds that the fact that the city engineer might have been looking after the work did not release the company from the duty resting upon it to keep that part of the street in safe condition. If the plaintiff knew of the dangerous excavation in the street, or had reason to believe that it existed, it was her duty, on approaching the place, to look for it and to avoid it.

PERSON ATTEMPTING TO BOARD STOPPED CAR A PASSENGER—STOPPING OF CAR AN INVITATION TO TAKE PASSAGE—WHEN NOT WISHED TO BE SUCH, NOTICE SHOULD BE GIVEN—A PERSON WHO CANNOT BE TREATED AS A TRESPASSER.

Hall vs. Terre Haute Electric Co. (Ind. App.), 76 N. E. Rep. 334 Dec. 6, 1905.

A man attempted to board a car at a point near which some cars were switched for a return trip and where such cars stopped only for the purpose of discharging passengers while other cars regularly stopped there for the purpose of discharging and transferring passengers. He wanted to board a car which continued its trip, but it would seem started to board one that was going to switch, and he alleged that he was thrown off and injured by the immediate starting of the car with a jerk. In holding that there was a case for the jury although the evidence was conflicting, the appellate court of Indiana, division No. 2, says that a street railway company is granted its franchise in order that it may carry passengers. When it brings upon the street a car equipped for such purpose, stopping the same at a place selected by it, at which to receive passengers, and the person desiring to be transported boards, or attempts to board, such car for such purpose, he becomes a passenger thereon; the act of stopping the car at the customary place being an implied invitation to those waiting to take passage. If the defendant did not wish to extend such invitation, its duty was to give those in waiting notice to that effect. The person desiring passage, who boards the car without such notice, indicating his intention of becoming a passenger thereon, cannot be treated as a trespasser. The plaintiff boarded a car which stopped at the usual place for the purpose of being conveyed to his destination. A special contract with the company, based upon payment of fare, was not essential to make him a passenger.

RIDING ON RUNNING BOARD NOT NECESSARILY NEGLIGENCE—CARE OWED PASSENGER—RISKS ASSUMED—COMPETENCY OF WITNESS TO TESTIFY AS TO SPEED.

Verrone vs. Rhode Island Suburban Railway Co. (R. I.), 62 Atl. Rep. 512. Nov. 10, 1905.

When a passenger got upon an open trolley car at a park the seats were filled, and passengers were standing between the seats, and he was able only to secure a position upon the running board. According to all the testimony, he grasped the post or the handle affixed to it with both hands as long as he continued on the car. As the car approached a hill, while it was proceeding along a straight and approximately level track, he fell off. Several witnesses testified that just previous to the accident the car swayed violently, and was jerked sideways with considerable force. One witness testified, without objection, that the car was going at an extraordinary rate of speed at the time of the accident. The supreme court of Rhode Island holds that it was error to grant a nonsuit at the conclusion of the plaintiff's evidence.

The passenger occupied this position on the running board, the court says, because there was no vacant seat in the car, nor standing room between the seats. This was not negligence per se. If the railroad company accepts passengers whom it cannot accommodate inside its car, it must do all that human care and vigilance reasonably can to prevent accident happening to them. No doubt it is reasonable to impose upon a passenger the assumption of such risks as ordinarily attend the position he takes, but he has a right to suppose that the car will be run with due care, and this requires greater precaution when passengers are occupying the running board than when all are safely seated. A shock sufficient to throw from the car a strong man holding on with both his hands might well be taken by the jury as evidence that the car was not properly managed. Therefore the court thinks that the plaintiff made out a prima facie case, and should have been allowed to go to the jury.

It is evident, the court says further, that it was a substantial issue in this case whether the car was proceeding as usual when the acci-

dent occurred, or was propelled at an extraordinary rate of speed, which would be likely to cause more violent and dangerous jolting and swaying than common. The passenger, when he took his place on the running board, assumed the risk of ordinary motion, not of extraordinary violence. Testimony, therefore, upon this subject would be admissible if offered by competent witnesses. The plaintiff in this case failed to qualify the witnesses whom he called on that question by first showing that they had traveled on this route, and knew the ordinary rate of speed at the place in question. For this reason, exceptions to the exclusion of their testimony must be overruled.

ACCEPTED FRANCHISE ORDINANCE A CONTRACT—HOW FRANCHISE RIGHTS MAY BE FORFEITED—FAILURE TO LAY PLANK OF PRESCRIBED DIMENSIONS ALONG RAILS—WHEN AND HOW EQUITY WILL RELIEVE FROM FORFEITURES—ACTIONS OF MUNICIPAL AUTHORITIES NOT JUDICIAL DETERMINATIONS—RIGHT OF RESORT TO COURTS—MAY HAVE INJUNCTION—CONSENT OF COUNTY COMMISSIONERS NOT SUFFICIENT FOR TOWN.

Wheeling & Elm Grove Railroad Co. vs. Town of Triadelphia (W. Va.), 52 S. E. Rep. 499. Dec. 12, 1905.

An ordinance, passed by the council of a town, granting to a street railway company the right to lay its track and operate its railway in the streets of the town, and accepted by the railway company, the supreme court of appeals of West Virginia holds, constitutes a contract between the town and such company, vesting title to such right or easement in it, unless the ordinance contains conditions precedent compliance with which is requisite to the vesting of title.

Such right may be forfeited and lost by failure to comply with subsequent conditions, and, if the ordinance expressly provides for forfeitures as the penalty of noncompliance with conditions specified in it, substantial performance of the contract as a whole constitutes no answer to a proceeding to forfeit for failure to comply with such conditions, however slight their relative importance may be. The question of materiality is, in such case, withdrawn from the courts by the stipulations of the contract.

A street railway license or privilege in a street may be forfeited for failure to lay planks of prescribed dimensions along the rails of its track in front of improved property, if the ordinance expressly gives the right to forfeit it for such cause.

Equity will relieve from forfeitures for nonperformance of covenants other than those for the payment of money, arising out of accident, mistake, or surprise, and in the absence of willful and deliberate refusal to perform, when no pecuniary injury has resulted to the covenantee and the wrong done is easily remediable; but such power of relief is discretionary, and will not be exercised unless the deliquent covenantor is able and willing to immediately perform the covenant.

Equity will not permit the enforcement of a forfeiture in an inequitable and oppressive manner, nor a perversion thereof to purposes other than those for which the power of forfeiture has been reserved. In the exercise of such power, under an ordinance of a municipal corporation prescribing notice and specification of cause as a necessary preliminary step, the officers of such corporation must deal fairly, openly, and frankly with the party whose rights they attempt to take away, and abstain from such conduct as will work a surprise upon him. Their conduct is governed by substantially the same rules and principles as apply to proceedings by private persons under similar circumstances. In order to be inequitable and oppressive, their conduct need not be actually fraudulent. If in equity and conscience it is oppressive or lacking in fairness, equity will relieve, however honest and sincere the parties attempting to forfeit may have been. The discretion of the court in such case is a sound legal discretion, subject to review, and the appellate court will reverse the action of the trial court when, in its opinion, relief has been improperly denied.

A declaration of forfeiture of a street railway privilege in a street by the council of a town, effected by repeal of the ordinance by which the privilege was granted, pursuant to a reservation of power so to do, for cause and after notice, has not the force and effect of a judicial determination of the existence of cause for forfeiture, and does not preclude a resort to the courts by the railway company for vindication of its rights. After such repeal, pursuant to notice, the railway company may, by injunction, prevent the town authorities from removing or disturbing its track, if no cause of forfeiture existed, or the circumstances shown are such as to call for the exercise of equity jurisdiction to relieve from forfeiture. The action of munipical authorities in granting and revoking privileges and licenses in highways is the exercise of delegated police power, and is not judicial in character.

Consent of the board of commissioners of Ohio county to the operation of a street railway on and over the Cumberland Road in said county of Ohio did not confer authority upon the railway company holding such permit to construct and operate its railway on and over such portion of said road as lies within the limits of the town of Triadelphia, in said county, without the consent of the authorities of said town.

DUTY TO AND OF DRIVER OF WAGON ON TRACK—CARE REQUIRED OF MOTORMAN—"ORDINARY CARE" AND "VIGILANT WATCH" DEFINED—MOTORMAN CEASING TO LOOK AHEAD WHILE SHUTTING DOOR—SPEED.

Theobald vs. St. Louis Transit Co. (Mo.), 90 S. W. Rep. 354. Nov. 22, 1905.

A car on an outlying, unimproved street on a dark night struck the end of a coupling pole which projected some feet behind a lumber wagon, so that the driver was thrown out. The jury were instructed "that it was the duty of the motorman of the car, while his car was moving forward, to keep a constant and vigilant watch on the track ahead," etc. But the supreme court of Missouri, division No. 1, holds that, this being an action under the common law, it was improper to so instruct the jury. Instead of telling the jury that it was the duty of the motorman "to keep a constant and vigilant watch on the track ahead," the jury should have been instructed that it was the duty of the motorman to exercise ordinary care to prevent a collision with injury to, the driver of the wagon. Such an instruction, coupled with one which defined what constitutes ordinary care, would have left the matter to the jury to determine whether under the facts and circumstances, the motorman had or had not acted with that degree of care which a person of ordinary prudence would have exercised, under the same or similar circumstances.

As above stated, the court says that this was a common-law action of negligence and not one arising under any ordinance or statute. The man was not a passenger on the car, neither was he a trespasser on the track; therefore the obligation of the defendant was to use ordinary care to prevent injuring him, and the correlative duty of the man was to use ordinary care to avoid being injured. There was no element of willfulness or wantonness in this case, and therefore the humanitarian doctrine had no application. The instruction complained of required the motorman "to keep a constant and vigilant watch on the track ahead." This is not a correct definition of the common-law duty of the motorman. The instruction should read that it was the duty of the motorman to exercise ordinary care to avoid injuring the man. "Ordinary care" was properly defined, in another instruction, to mean, "that degree of care which a person of ordinary prudence in the same occupation would use under the same or similar circumstances as those shown in the evidence." Ordinary care might or might not require the motorman to be looking ahead on the track. But there is a vital difference between the requirements of ordinary care and the duties imposed by this instruction "to keep a constant and vigilant watch on the track ahead." A "vigilant watch" means, in the common acceptation of the term, an exceedingly careful watch. At any rate, the use of that term is well calculated to cause the jury to believe that the court intended to impose a stricter duty on the defendant than was ordinarily required. Yet the defendant's duty in this case was to exercise ordinary care.

Nor does the court apparently consider that the defendant's case was to be affected by the fact that the motorman momentarily ceased to look ahead while he shut the door, there being no evidence that he could have seen the wagon any sooner than he did if he had been looking forward and had not ceased so to do while shutting the door.

The rate of speed, whether it was 15 miles an hour or 8 miles an hour, the court says was not of itself a dangerous speed.

Piping and Power Station Systems.—XVI.*

BY WILLIAM L. MORRIS, M. E.

Steam Branch to the Heater Coil in the Engine Receiver.

This steam connection belongs to that class of small station piping details which secure economy only by complicating the general system of operation. It is generally known that reheating the exhaust after it leaves the high-pressure cylinder greatly improves the lubricating conditions in the low-pressure cylinder, but little other benefit is thus secured. To avoid an actual loss of heat it is necessary to return the drips from the reheater to the boiler in such a manner that the heat units in this high-temperature water are retained. An efficient method of accomplishing this is to pipe the return drips to the boilers independent of the regular feed main.

In Fig. 138-(A37-1) is shown the usual arrangement for connecting a receiver between the high and low-pressure cylinders. The live steam passes to the reheater coil through the connection, a. The drips pass through the pipe, b, and are received by the pump, c. This pump allows the pressure in the pipe, b, to be less than that in the steam pipe, a. The steam branch, a, may be taken from the engine branch or from the upper portion of the main header, but a better method is to take the steam from the drip opening of the steam separator or from a drip pocket in the main header. These drain details will be taken up more fully under the subject of "Drips."

Steam Branches to and from Superheaters.

The special features in regard to the handling of superheated steam are presented under the headings of "Gaskets" and "Expansion and Contraction", both of which subjects appear later. The superheater when placed in a boiler setting becomes a part of the boiler and no provision should be made for a by-pass around it since its location in the furnace is such that unless steam is flowing through the superheater it will soon be damaged.

The principal difference in pipe lines for superheated and saturated steam is the reduced size of the former. This reduction is favored by the manufacturers of superheaters since they have proven by demonstration that it is more economical to increase friction losses and reduce the loss by radiation than it is to increase the loss by radiation and decrease the friction losses. This radiation loss may also be avoided in the use of saturated steam.

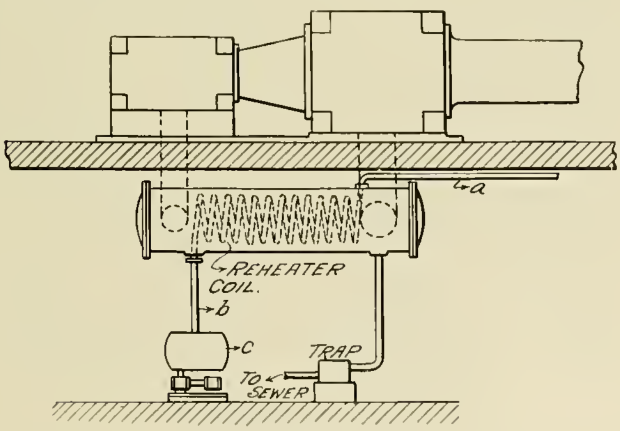


FIG. 138—(A37-1).

The subject of radiation from extremely large pipes, receivers etc., is not sufficiently considered in connection with the use of saturated steam. The boiler manufacturer will guarantee a certain quantity and quality of steam as it leaves the boiler and the engine manufacturer will guarantee to perform a specified amount of work with a certain quantity and quality of steam delivered at the throttle. Until the superheater manufacturer came into the market, no one had interested himself sufficiently to guarantee a maximum loss between the boiler and the engine. The manufacturer of the superheater has to assume this loss in connection with his apparatus since the success of his business virtually depends upon reducing this loss to a minimum and in seeing that the superheater receives the credit for the saving.

The use of small radiating surfaces for superheated steam is essential on account of the high temperature and rapid radiation. The entire volume of superheated steam in a pipe is not all of the same degree of temperature, and this point should not be overlooked in making piping arrangements for superheated steam. This fact is well understood by manufacturers of superheaters and to insure a uniform amount of superheat, a number of methods are resorted to for bringing all or as much of the steam as possible to the heating surface.

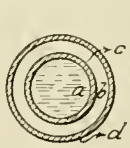


FIG. 139—(A38-1).

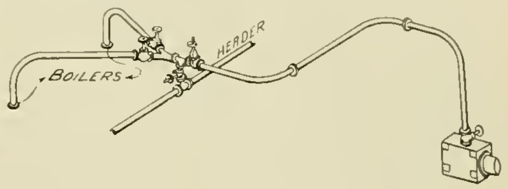


FIG. 140—(A38-2).

One method of doing this, by removing the "core" in a superheater tube, is shown in Fig. 139—(A38-1.) The steam in the space, a, is out of the circulation of the flowing steam, being confined inside the tube, c. The steam in space, b, is that which is flowing and taking up the heat delivered by the outer tube, d. If the tube, c, were not placed in the position shown, the steam would travel through the space, a, and, due to the frictional resistance of the tube, d, the steam next to this tube would move slower than that at the center. Since this steam at the center will take up superheat slowly, it will cause the tube, d, to be raised to a very high temperature and thus reduce its conductivity and capacity.

When passing through supply lines the superheated steam flows through the center of the pipe. The steam lying next to the pipe is deprived of its superheat and condenses. The amount of steam that will be thus condensed is determined by the radiating surface of all the lines between the boiler and the machine using the steam. If the lines throughout their entire length are small, very short and the steam flows through them at a rate of 10,000 ft. per minute, little or no condensation will take place, and the losses by radiation will be shown by the loss of superheat. Large headers, steam receivers, etc., should be avoided when superheated steam is used. Condensation may not show in the lines while running, but it is necessary to provide as ample means for removing the condensation as would be used in piping for saturated steam. Large drip pockets, etc., should be avoided, and in every detail radiation should be reduced to the least possible amount. It may be possible to locate the steam main and its branches in a portion of the building where air can be confined and the radiation losses reduced. The principal advantage to be gained by the use of superheated steam is the saving in condensation losses.

Whatever precautions are taken toward reducing the condensation losses between the boilers and the steam-driven machines are savings, whether the steam used be saturated or superheated. A slight pressure drop in the use of superheated steam may be allowed in order to save heat units, but the maintenance of the boiler pressure as far as the engine throttle when using saturated steam is open to argument. The subject of the determination of losses will be taken up in a later chapter.

There is a certain size of line which will give the least total loss for every requirement. With a given line a slight saving in the one class of loss is accompanied by a correspondingly greater loss in the other class. The tendency seems to be toward the use of large headers and pipes, thus increasing the heat unit losses. In many situations the present pipe lines could be considerably reduced in size

and if carefully planned would not cause any increase in the pressure drop from the boiler to the steam-driven machine. Fig. 140—(A38-2) shows a system of piping suitable for superheated steam. The header is small and more in the nature of an equalizer or emergency line, being possibly the size of the engine connection. For regular service, the steam would pass from the boiler directly to the engine without any abrupt turns. The small amount of steam passing through the header from one unit to another would bring about the only noticeable heat loss. If it is found to be desirable the header may be shut off and each unit used separately.

Steam Branch to Turbines.

The general design of steam branches to turbines should be much the same as those for engines, embodying in addition the special features pertaining to superheated steam. One special feature in

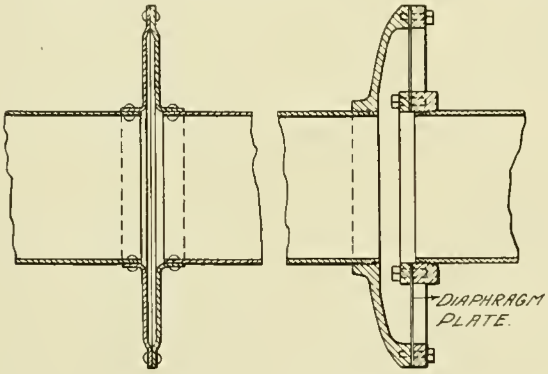


FIG. 141—(BI-1) AND FIG. 142—(BI-2).

regard to these connections is the size of pipe required. An engine which cuts off at one-quarter of its stroke and has a pipe branch in which the ultimate steam velocity does not exceed 10,000 ft. per minute, would require a branch which would have four times the cross-sectional area of the turbine branch in which the steam is flowing continously. A reciprocating engine not only requires a full amount of steam at short periods but also makes necessary the alternate acceleration and retardation of the volume of steam flowing through the steam connection. The pressure in a large steam main will show a very perceptible change on account of the cut-off of the engine, this change being caused both by the sudden withdrawal of the steam to the engine and its consequent expansion, and also on account of the inertia of the steam at the high velocity being suddenly brought to a stop. Steam turbines relieve the pipe systems of these steam vibrations. Such vibrations as may be caused by the turbines in taking steam are not productive of pipe vibrations on account of the short period of the vibrations and the inability of the heavy masses to pulsate in synchronism with them.

Vacuum Exhaust Piping.

The vacuum lines are in most cases the largest pipe lines in the plant, and special care should be taken in their design in order to reduce the loss of head in the flow through them. The loss of but one-half a pound in a pipe line means one inch less vacuum at the engine than at the condenser. A loss that would scarcely be measureable in a steam line would be too great to be allowed in a vacuum line. Ordinarily, with 26 in. of vacuum, there would be 70 cu. ft. of steam passing through the vacuum line for each cubic foot passing through the live steam line, and 10 cu. ft. of atmospheric exhaust to 1 cu. ft. of live steam. An engine having a 12-in. steam line will ordinarily have a 24-in. exhaust. Assuming that the continuous flow of a 6-in. line is equivalent to the flow of a 12-in. line when steam is cut off at one-quarter of the stroke or in one-quarter of the time, there is a diametrical ratio between the 24-in. exhaust and the 6-in. steam main of 4 to 1 and an area ratio of 16 to 1. The volume of vacuum exhaust being 70 times that of steam, it is then true that steam in vacuum lines must have a velocity about four and one half times that of the steam in the live steam connection.

It is due to this higher velocity, bad bends in the line and other friction losses that the vacuum at the engine is in many cases so much less than at the condenser. In steam turbine practice where an extremely high vacuum is maintained, 1 cu. ft. of boiler steam will expand to a volume of about 130 cu. ft. in 28 in. of vacuum. Therefore the diameter of the exhaust should be 11 times that of the steam lines to maintain the same velocity as that of the boiler steam. If it were possible to reduce the velocity of the vacuum steam by using larger lines, then it would also be possible to use a longer pipe line with the condenser located in a more advantageous position. By way of illustration a 10-in. steam line under the stated conditions would require a vacuum exhaust line 9 ft. in diameter.

It has been found practical to pipe only the smaller turbines into a high-vacuum main. The economies of the different vacuums have been determined by actual tests and the engineer is therefore able to determine how much yearly loss he will think justifiable in order to effect any desired piping system. For large units using higher vacuums the type of construction affording the highest vacuum and the least resistance to the flow of steam is the one most desirable. Not only should the connections be short and of a large diameter but the shape of the mouth and discharge openings should also be properly designed, as the loss between the turbine and condenser can often be reduced one third by so doing. The loss of one inch in vacuum on a compound engine causes an increase in the steam consumption of less than one per cent, but the loss of one inch from 28 to 27 in. of vacuum on a steam turbine increases the steam consumption about six per cent. It would therefore be possible to design a vacuum main for engine work that would be quite impracticable for use with turbines.

The friction losses should also be reduced as much as possible in the vacuum lines. A 1,500-kw. unit will in most cases generate about 9,000,000 kw. hours per year, the generating cost for labor and fuel being about $60,000 per year. This would mean a yearly loss of $600 for each inch of vacuum lost by friction. This sum would pay the interest and depreciation on an additional investment of $6,000 to cover the necessary cost of larger piping which would reduce the loss one inch. The increased cost to reduce this friction loss would be comparatively slight, being possibly the expense of more careful study in laying out the original system.

But little useful data is available to determine the amount of the losses through the fittings, valves, etc., required in the different pipe lines. These features will later be taken up in detail. The branch from the vacuum main should be short to avoid line loss; to care for expansion this connection should be long, as in the case where but two pieces of apparatus are tied to the main. To comply with these conflicting demands a compromise is necessary. The amount of strain that can be safely placed on pipe work has not been sufficiently determined to be useful in making calculations and this subject will also be entered into more fully in a later discussion

The details used in providing for expansion other than that of the pipe itself are invariably some form of elastic joint or pipe. Fig. 141—(B1-1) shows a diaphragm joint made of steel plate, riveted and caulked. This joint has been found very satisfactory for use

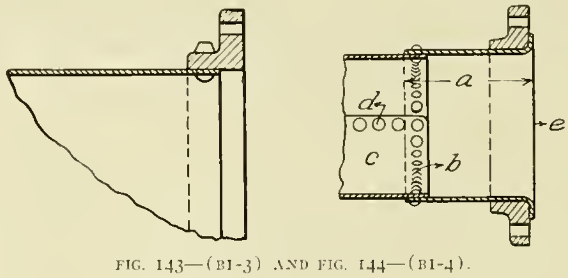


FIG. 143—(BI-3) AND FIG. 144—(BI-4).

on large, riveted mains. Such riveted work is used extensively for large exhaust and vacuum pipes. It is not the riveted work that is especially wanted, but the increased size of the mains.

Fig. 142—(B1-2) shows one of a variety of forms of diaphragm joints used on welded pipe and made in the pipe shops. The form shown in Fig. 142 is a design which must be made in the pipe shop and should be assembled by the pipe fitter. The form illustrated in Fig. 141 should be made in the boiler shop and assembled by the boiler maker. If the large mains are made in the boiler shop it will be found advantageous to have the boiler makers assemble and erect them. The practice of riveting heavy flanges to the shell of the pipe is not considered good detail work, whether the flanges be made of cast iron or steel. The best boiler shop practice is to rivet together sheets of like thickness and allow the riveted joints to be as

flexible as possible. The form shown in Fig. 141 is considered good boiler shop practice since it affords an opportunity for applying the rivets and for driving and caulking the joints, all the rivets being short.

To avoid such a design as is shown in Fig. 143—(B1-3), where the pipe lines connect to the flanged faces of the machines, the connection as illustrated by Fig. 144—(B1-4) should be used. The portion, a, should be made of steel plate about 12 in. wide and without a straight seam. The lap edges of the plate should be welded before the flange is turned over. The holes should be punched in the circular seam, b, for the plate, a, only. The end of the section, c, should be left long and the rivets in b, omitted for a distance of about a foot from b until the circular seam is riveted. The section, a, should be bolted in place and c be in position before marking off the holes in the seam, b, at the end of section, c. If the flange end of a be turned over on a faced forming block and a wooden maul be used to drive the flange over and a true flatter be used to finish the face after it is turned down, it will not be necessary to face the joint, e, since the unevenness will be very slight.

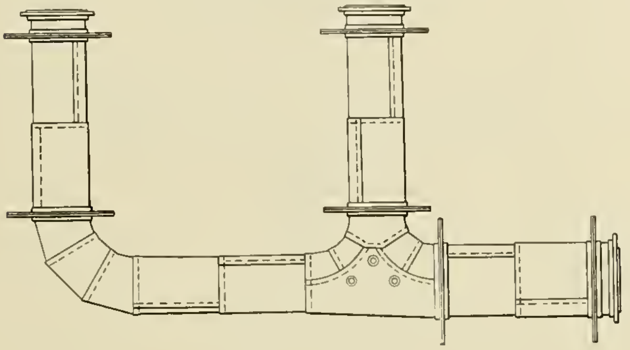


FIG. 145—(BI-5).

In a design as shown in Fig. 145—(B1-5), the expansion and contraction would be taken up by a side movement of the different sections. Fig. 146—(B1-6) shows a diagram in which the position of the parts when cold is indicated by solid lines and when heated, by dotted lines. The difference in position of the parts when cold and hot as indicated by, a, may be assumed as one inch, the joint, b, being on a 36-in. pipe. The radius of the pipe being 18 in. and the swinging section 96 in. long, the movement at the joint, b, will be 18÷96 in. of compression on one side and the same amount of tension on the other, there being no movement at the top and bottom of the diaphragm. The movement at the joint, b, would be 3-16 in. or 3-32 in. on each of the diaphragm plates. Unless some such provision as is here shown be made for the expansion strain, much trouble will be caused by leaks throughout the riveted work.

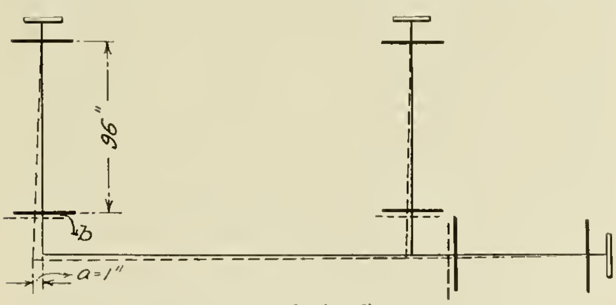


FIG. 146—(BI-6).

In case the line be made of regular welded pipe with flanged fittings, the strain can be similarly taken care of with corrugated copper connections as is shown in Fig. 147—(B1-7). The flange, a, should be made of wrought iron, steel or a steel casting because corrugated copper expansion joints are quite expensive and it becomes very difficult to make repairs in case of the breaking of the cast-iron flange. If the joints are to be ordered it should be specified that they be made of steel as it is customary to furnish such joints with cast-iron flanges. The joint faces of fittings and flanges should be made with an adhesive gum packing which should be preferably free from graphite, so that in case the pressure on the gasket is released, there will be no danger of a portion of the gasket being sucked into the pipe by the vacuum.

A simple method of preventing the gasket from being drawn into the pipe is to make the edge of the raised joint face as is shown in Fig. 148—(B1-8) and let the outside diameter of the gasket be the diameter inside of the bolts. The gasket will have a thick edge on the outside of the joint, shown at a, due to its compression on the joint faces only. The shoulder on the gasket should be formed gradually without any perceptible angle and not as shown in Fig. 149—(B1-9), which practice causes a weak point in the gasket where

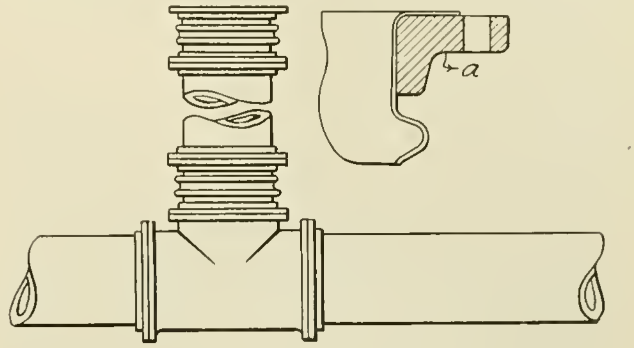


FIG. 147—(BI-7).

the bead and the compressed portion join. This weakness may not show for a considerable time, probably not until the gasket becomes hard and brittle from the heat of the steam or soft and gummy from the effects of the cylinder oil. Cloth insertion or rubber packing is not as suitable for gaskets on a vacuum line as some adhesive type of packing.

The valves for vacuum lines are invariably of the gate pattern, and in order to give satisfactory service, they should be what is commonly styled the 100-lb. pressure valve. The so-called "light-pattern" exhaust valves are not rigid enough to maintain their perfect form under excessive expansion strains and do not permit of their being closed air-tight. In the general arrangement diagrams, Figs. 47 and 48, (Street Railway Review, June, 1905, page 372.) the vacuum lines are shown and each engine is provided with a shut-off valve. When the load drops from the engine it is advisable to provide some means of quickly opening or closing this shut-off valve to prevent the engine from running above normal speed. The operating device should be placed close to the steam throttle. An indicating wattmeter should be provided for each generating unit, located on the gage board or at a place where it can be clearly seen from the operator's position while at the engine throttle. The exhaust valve may be operated by a small motor or by a hydraulically-driven piston. The indicating wattmeter shows instantly when the load is thrown on the machine and whether the load is being increased or diminished, thereby enabling the operator to regulate the steam and vacuum valves accordingly.

The value of an indicating wattmeter at the engine has been so

FIG. 148—(BI-8) AND FIG. 149—(BI-9).

fully demonstrated that where it has been installed, the attendant is often guided more by it than by the steam or vacuum gage. He keeps a constant watch on the wattmeter and intermediate gage and raises the intermediate pressure when he sees that the load on the engine is increasing. The wattmeter at the engine has nothing to do with switchboard work or with the electrical control. It merely shows the attendant what work the engine must do and makes his duty more definite.

Where there are two or three large engines on a condenser and the load is liable to drop off instantly, there is always a possibility that the engines will run away. To avoid this, it is quite necessary to break the vacuum as soon as possible. On account of the large volume of steam at a rather high pressure in the low-pressure intermediate receiver it is not sufficient to close the steam throttle. Even though the main throttle be instantly closed when the load

falls off the engine, it will be some time before the pressure in the intermediate receiver is lowered through the low-pressure cylinder. The automatic stop valves furnished by engine builders are not as a rule sufficient to save the engine. A 1,500-kw. unit might be in parallel with other machines running condensing and developing 500 kw. with the automatic butter-fly valve closed. This entire load would be carried by the low-pressure side alone. By observing the wattmeter and tachometer on an engine, it will be noted that the highest engine speeds occur when very light loads follow the heavy loads. This situation occurs in its most severe form when an engine has been very much overloaded, thereby throwing the breaker and losing its entire load in less than one revolution. The attendant should be able to at once throw a switch on the engines and close the vacuum valve.

For two reasons it is quite out of the question to operate large vacuum valves by hand. First, because it takes so long to operate the valves by hand that much harm may be done elsewhere before the operator can get away. Second, because after quickly closing, say a 30 or 36-in. valve, the operator is in no condition to do anything else for a time, since the handling of these large valves requires the expenditure of considerable energy. Referring again to Fig. 48, it will be noted that the vacuum stop valves for each engine are so situated that it would be extremely difficult to reach them while controlling an engine. By using a motor-operated valve, the switch controller may be placed wherever it is most convenient.

The atmospheric valve should also be given full consideration in connection with engine control as it must operate in unison with the vacuum gate valve. In Fig. 150—(Bi-10), is shown the general form of an atmospheric relief valve of the vertical type. The dash pot is placed on the outside where it can be inspected, cleaned or repaired while the valve is in use. This type of valve is suitable for plants that are to be well maintained. If they are not to be well kept it would be advisable to use an interior type of dash pot, using condensation in the dash pot instead of oil as would be the case with the exterior type of pot. An oil dash pot, when in good order, will operate very satisfactorily, but if it is allowed to become gummed or clogged with dust and dirt its smooth working will be greatly interfered with. The stuffing box of the valve shown in Fig. 150 may be loosely packed as it is on the atmospheric side of the valve. The atmospheric valve should be provided with tapped openings, say 3/8 or 1/2 in. in diameter, for a small water connection and an overflow. These connections are valuable in determining whether or not the valve leaks, and in showing the amount of leak and in preventing air from leaking into the vacuum line. Without this connection, it is very difficult to determine whether or not the valve leaks air.

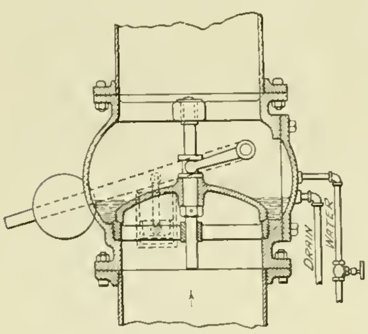


FIG. 150—(BI-10).

One of the most approved forms of the interior dash-pot type of atmospheric valve is shown in Fig. 151—(Bi-11). This is of the horizontal type. The opening, a, is for the small water connection, while the opening, b, is for the overflow. The flange, c, is provided to retain water over the valve face. The hand wheel and screw shown at, d, are used to raise the valve from its seat as would be required if it were running non-condensing for a considerable time. The valve shown in Fig. 150 should have a side plate that can be removed in case it is necessary to regrind the valve to its seat. The valve shown in Fig. 151 can be readily reground by removing the top cap. The guide can be held in place by using blocks under the heads of the screws.

Atmospheric valves are subjected to rather extreme demands, the requirement being a tight valve with but little pressure on the seat face. These valves can be ground to the best advantage in the shop, but in most cases after they have been put into service they will soon show bad leaks. This condition is quite unavoidable and can hardly be called a defect. The body of the valve is a heavy casting in which the moulding strains are relieved by subjecting it to the steam temperature. At the end of a week's run, the valve may leak badly, and after grinding it may be perfectly tight. Then at the end of a month's run it may again show some leak and require regrinding. It may not then show any perceptible leak for a year or more. The tendency of a casting is to relieve it-

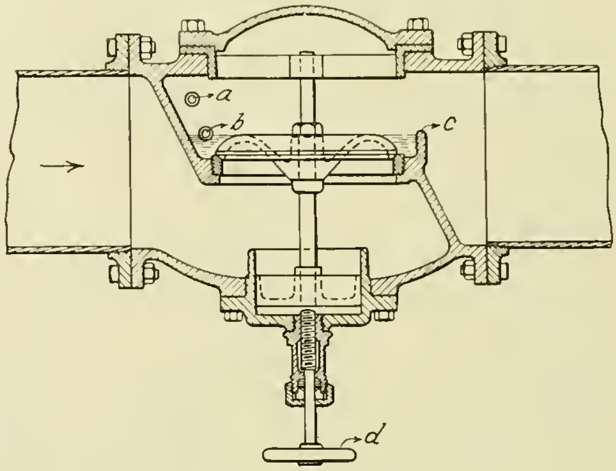


FIG. 151—(BI-11).

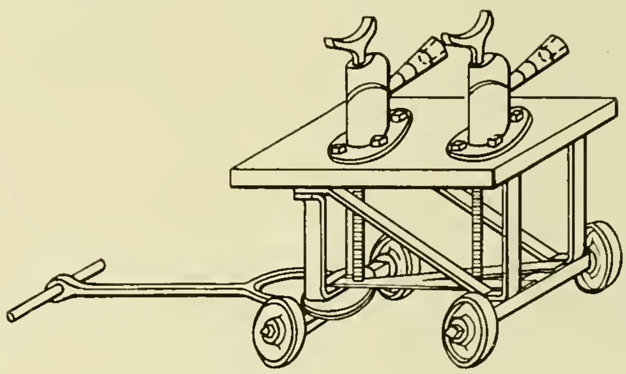
self of the moulding strain and each time the valve is reground it is in better shape than before. There does not seem to be any practical way of overcoming this difficulty.

There is another type of atmospheric valve which is frequently furnished by the engine builders. This valve is intended to be positively operated by hand, instead of being automatic in closing.

(To be continued.)

A Convenient Pit Jack

In the January issue of the "Street Railway Review" was shown a view of the elevated repair track in the new Fair Oaks car house of the Madison & Interurban Traction Co., recently equipped for maintaining the rolling-stock of the system. There is no pit under this track as its elevation is high enough to permit a workman to stand in a comfortable position when repairing the trucks. It was therefore necessary to purchase or build some sort of a


SIMPLE ARMATURE JACK USED AT MADISON, WIS.

jack which could be used in handling armatures from their position on the car to the winding room, half-way down the building. For this purpose the employes rigged up a portable jack, which is illustrated herewith.

As will be noted this jack consists of a four-wheeled running gear upon which is mounted an elevated table supported at a position about four feet above the floor. On top of this table are bolted two ordinary small track jacks in which have been placed extra long lifting bars. These may be seen extending below the bottoms of the jacks. By this arrangement of parts and by the use of a short handle, an armature can be quickly and easily taken from under a car, lowered so that it will pass under the track stringer or out of the end of the track, and wheeled to the repair rooms.

The New Car House and Shops of the Binghamton Railway Co.

The new storage and shop building of the Binghamton Railway Co., Binghamton, New York, which has recently been completed, presents an excellent example of modern car house construction. As will be noted in the illustration, the building is of a pleasing design and is substantial in appearance. In its design special care has been taken to make the completed structure as nearly fire-proof as possible, and several very recent fire-proofing ideas have been used. The building is equipped with a number of modern devices for handling and facilitating the work of car repairing.

The building is situated near the river bank where a retaining wall has been built to provide a bed for the tracks leading out of the building. The building occupies a ground space of 50 x 92 ft. and is two stories high. The side walls are of brick and rest on a concrete foundation extending below the frost line. The roof is supported by steel girders encased in concrete and the steel pillars supporting these girders also have an outside covering of concrete and neat cement over wire mesh. The boiler room is located a few rods away from the main building towards the river and is surmounted by a tall iron smoke stack.

The ground floor of the new building is divided into three general divisions by partition walls. The largest of these divisions is the car storage room which extends the entire length of the building. It contains four tracks under two of which is a pit. In the storage room are three hydraulic hoists which are a part of the very complete hoisting equipment that has been installed in the storage and repair rooms. These hoists have a lifting capacity of three tons and a range of 42 in. They are operated separately for raising or lowering armatures or motor frames from the trucks to the floors. Each jack has an 8-in. cylinder and a 2-in. piston rod. They are operated by city water under a pressure of 65 lb. per sq. in.

In the rear of the storage room is located a fire-proof vault 8 x 10 ft. in floor area, which extends from the ground floor to the roof. Adjoining this vault are lavatory and toilet facilities for the use of the employes.

INTERIOR OF REPAIR SHOP SHOWING PIT AND HYDRAULIC HOIST.

The repair shop occupies the middle bay of the building and contains two tracks, one of which extends completely through the building. The accompanying illustration shows a portion of the pit serving both the tracks in this room. The track rails are carried on steel I-beams which are in turn supported by brick columns one foot square. In this pit are five hydraulic hoists similar to those previously described in connection with the car storage room. At the front end of the south track two of these hoists are located near together for handling armatures under double-truck cars. The others are far enough apart for simultaneous use on different cars.

In the front part of the repair shop, located near the portion of the new bay which is set off for carpentry work, is the large hoist used when it is desired to lift a car body so that its trucks may be run out for repairs. The hoist is placed in a pit directly under the track, and is arranged to raise under the center of the car body and thus push it up from below rather than lift it from above, as is the usual custom. This method of operation does away with any structure above the car. The hoist proper consists of a 30-in. water cylinder with a piston rod 3 in. in diameter, lifting directly under a square frame work of I-beams, the upper beams supporting short sections of the track rails. When the jack is not in use the track is continuous throughout the length of the building. The frame work of the jack is provided with guides at its four corners which assure a firm base for the car body when it has been lifted off the trucks. This hoist has a lifting capacity of 30 tons through a vertical distance of 48 in. The movement of the hoist is controlled by a three-way valve located in the pit and the waste water from this jack, as well as from all others, is carried to the river through a system of sewers, as shown on the general plan drawing.

EXTERIOR OF THE NEW CAR HOUSE.

In the rear of this middle bay is located a hydraulic elevator which has been installed to carry armatures and other apparatus from the shops to the winding room on the second floor.

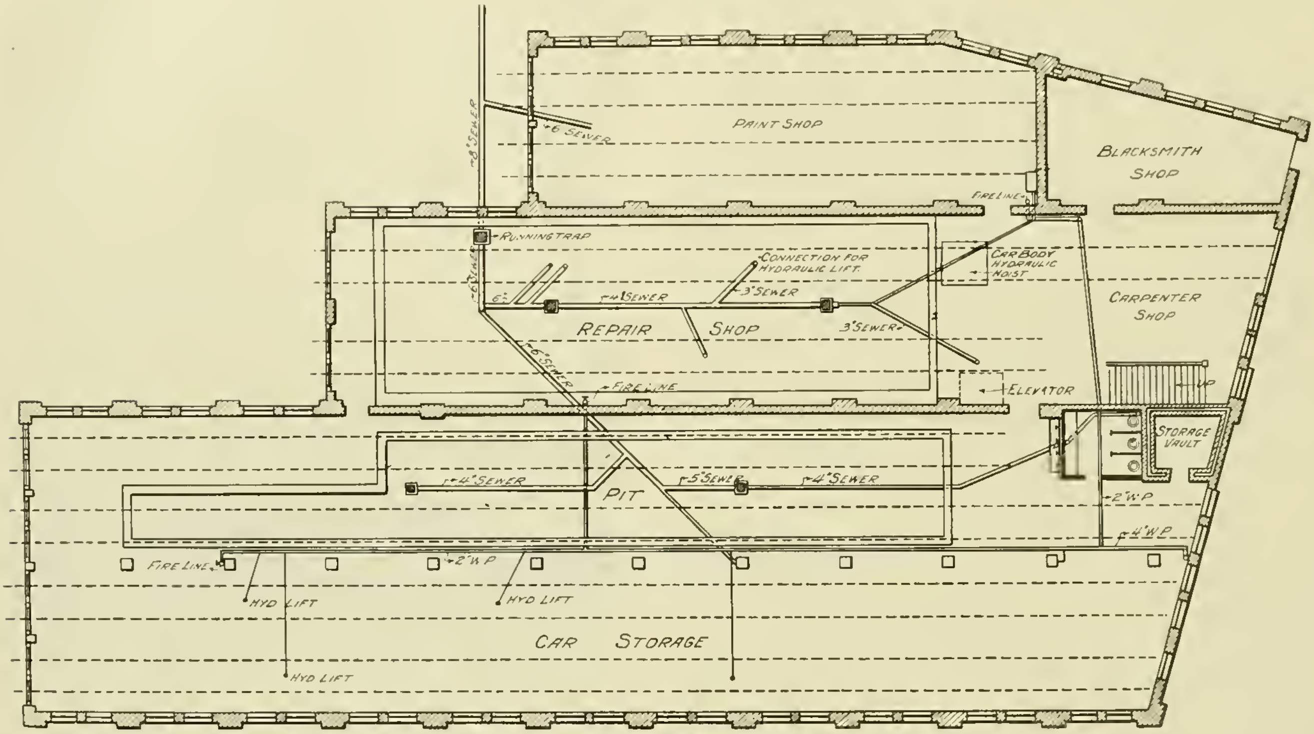
The third bay on the ground floor is divided by a partition into a paint shop occupying the forward end, and a blacksmith shop in the rear. The paint shop has two tracks, and both the shops are well equipped with every modern convenience for facilitating the work.

The floors throughout the lower portion of the building, as well as the pits in the shops and storage room, are of concrete, and fire-proof doors have been used throughout the interior. The lower floor is lighted by 52 windows in the side walls and by sashes placed in the upper panels of the doors.

The building has been carried up to the second story only over that portion of the ground floor containing the car storage room. The second story contains the general offices of the company and the armature winding room. On this floor are also the private offices of the president and general manager, the directors' room, several storage rooms, a room for the use of the employes, a filing room and toilet facilities. The partition walls and ceilings on this floor are made of asbestos composition and finished with plaster made of wood pulp. In addition they have been given a coat of white sand paint. The flooring of the main office is composed of inlaid tiles, while in the armature winding room, a concrete mixture has been used on the floor as in the remainder of the building. Forty-seven windows have been placed in the second story and skylights have been added in order that the building may be well lighted. Ventilation has been increased by circular transoms placed in the gable ends. With the exception of the oak mop-board in the office and the outside doors and window frames, nothing of an inflammable nature has been used in the entire construction.

As an additional precaution fire plugs with two-inch taps direct-

connected to the city water mains have been installed at convenient points about the building, as indicated on the accompanying floor plan. The pressure in these mains is 65 lb. Reels of fire hose of sufficient length to reach to all parts of the building, are placed near each tap and are always ready for immediate use. The cost of installing this system was nominal compared with other systems, and the company considers it very effective in getting at the seat of the trouble in case of accidental fire.



FIRST FLOOR PLAN OF THE NEW CAR HOUSE—BINGHAMTON RAILWAY CO

The heating system of the building has been carefully laid out and is the work of the firm of Shapley & Wells, of Binghamton, who also furnished the hydraulic hoists. The steam supply for heating purposes is obtained directly from the headers in the engine room under a pressure of 120 lb. The steam is led from the boiler room under the floor of the engine room to the basement walls. Here it passes into the ground and through a tile conduit covered with asbestos to the new building Upon entering the shops the main is carried to the top of the building where the steam passes through a reducing valve. By means of this valve the boiler pressure is reduced to any pressure desired. A by-pass is provided to carry the steam around the reducing valve in case of accident.

The reducing valve leads into a five-inch pipe which, as it passes through the shops, is reduced successively to four, three and two and one-half inches, all being used as main feed lines. In connecting from the main line at the top of the building to the radiators below, two-inch pipes are used. Each of these is in turn reduced to one and a half inches and connects to two separate heating coils which feed into six one-inch pipes running each way the length of the building. In the paint shop 12 pipes extend along the two sides of the room. In the repair shop the steam pipes extend along the north side of the building and provision is made for carrying them into the pits in case such a procedure is found desirable. In the main storage room the heating pipes extend along either side. A total of 8,000 ft. of pipe is used inside the main building for heating purposes. Each set of six pipes constitutes a heating unit and is regulated by a valve at the coil. Radiators of small surface are used in heating the offices.

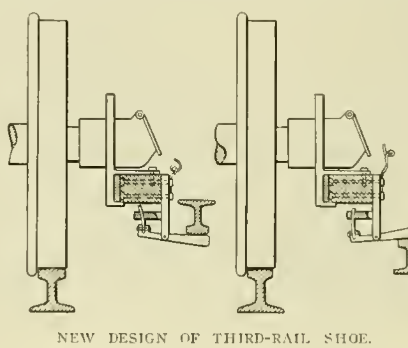
The return pipes increase from two to four inches in size as they pass through the building and lead directly into a tank 18 x 24 in. in size, located in the boiler room. The returns from the heating system are regulated in flow to the boiler feed main by a float valve which allows the returns to pass into the boiler feed water supply at a moderate pressure.

The Binghamton Railway Co. operates 32 miles of track. With the exception of a distance of two miles between Binghamton and Endicott, the track has all been relaid with new rails during the past two years. The old shops which are less than 100 ft. from the new building are to be used as storage rooms for extra cars.

The officers of the company are: G. T. Rogers, president; J. B. Rogers, secretary; H. C. Hardie, treasurer, and J. P. E. Clark, general manager.

A Double-Running Third-Rail Shoe.

Recent changes in the design of third rails have made it necessary for the cars of some roads to be equipped with third-rail shoes, which can serve their purpose equally well when operating on track having either the over or under-running type of contact rails. The accompanying illustration shows a type of contact shoe for which patents have been issued to Leonard Wheeler of the Chicago, Harvard & Lake Geneva Ry., and John T. Murphy of Chicago.



NEW DESIGN OF THIRD-RAIL SHOE.

Briefly stated, this device consists of a flat collecting plate pivoted at a point near its center and held in proper contact with the rail by means of a leaf-spring which, acting in either one of two directions, assures a steady pressure of the contact part of the shoe against the head of the rail. This device is said to work equally well on either the under or over-running contact rails and to require no attention from the crew when a car passes from one type of third rail to another.

March Meeting of the New York State Association.

The second quarterly meeting of the Street Railway Association of the State of New York was held at the Rathburn Hotel, Elmira, New York, March 29th. The meeting, which was well attended, was devoted to the discussion of transportation topics.

President R. E. Danforth made a few preliminary remarks after which B. V. Swenson, secretary of the American Street & Interurban Railway Association, addressed the meeting in the interests of the organization which he represents. He reviewed the history of the American association and told of the good work it is now doing for the betterment of electric railway interests throughout the United States.

The first paper, prepared by H. E. Smith, of the Hudson Valley Ry., treating of the subject of advertising and the best methods to follow in getting good results, was read, in the absence of the author, by the secretary. In part the author said that on account of the varying conditions to be met by each railway company there is no set rule to follow. The people in each community must be studied and the advertising methods must be such as will excite interest in the parks and other attractions served by the road. It is necessary to experiment with many methods until one that brings results is found, then follow up this method. A direct appeal, either by letter or personal interview, to the churches, lodges and other societies of the cities served, setting forth the advantages of the parks and amusement places reached by electric cars, usually brings good results. Announcement cards on the front of all cars, and wide hangers, time tables and comprehensive notices treating of the historical, picturesque or manufacturing communities served, also have a far reaching effect. Small advertisements posted in hotels bring good results. Mr. Smith further stated that to get the best results from special advertisements they must be attractive and must be presented to the people on the impulse of the moment. If advertisements are posted too far in advance the people forget them and the desired results are not obtained.

The permanent business is what a company should especially encourage. In reaching for the trade, maps and time tables should be kept in conspicuous places, cars should be kept clean and good connections should be made.

In soliciting freight and express business a personal canvass of the merchants, asking them to give the electric freight service a trial, is the most effective. The solicitor should then call on the trade frequently and foster a pleasant feeling for the road.

B. E. Wilson, general passenger agent of the Rochester Railway Co., said that good results can be obtained through special advertising, calling attention to what is to happen at parks and resorts. Last year a free concession was granted to a local organization to run a two weeks' carnival at one of the Rochester Railway Co's. parks. This feature created a very satisfactory travel over the electric lines. Another original scheme which has been successful at Rochester is "Toy Day," when 100 tickets redeemable in children's toys, were placed in secluded spots about the park and the children ecouraged to search for them. Mr. Wilson found kite-flying contests to draw well. The means of advertising which bring the best results to the Rochester Railway Co. are dash signs and attractive folders. The latter contain, besides a map of the railroad and a schedule of the cars, information of much interest to passengers.

W. W. Cole, Elmira Water, Light & Railroad Co., said that his company obtains the best results from folders issued regularly, which contain views of the community served by the railway. These are preserved by the passengers, while folders containing reading matter only are destroyed. He thought afternoon excursions should be encouraged and the evening travel would take care of itself. He also favored having evening attractions arranged so as to distribute the crowd.

E. S. Fassett, superintendent of the United Traction Co., Albany, N. Y., did not believe in distributing advertising matter. His company contracts for all of its space with an agency, and believes it is better to create a building boom or influence new manufactories to locate in territory served by the line, than it is to spend money for park attractions.

Some discussion was indulged in as to the merits and demerits of giving free tickets to children when accompanied by an adult, for passage to and from parks and other places of amusement. It was suggested that periodical distribution in this manner be made at the school houses and tickets be placed in the hands of the teachers. It was agreed that this scheme would possibly bring good results, but in many cities would not be allowed by the school board.

The question as to whether accidents to passengers increased in proportion to the travel where excursions were encouraged, was discussed. The general expression was that as the travel increased the possibility of accident also increased. During the morning several members of the association gave their views on the advisability of allowing liquors to be sold in parks. Both wet and dry parks had their adherents and many cases were cited where the one or the other was the most popular according to the conditions.

C. Loomis Allen, general manager of the Utica & Mohawk Valley Ry., stated that he believes the best results in advertising are obtained through time tables and reading notices placed in the local papers. In return for space thus occupied his company furnishes six local pass books of 50 coupons each to each daily and one city and one interurban book to each of the weekly papers. The books can be renewed as often as needed, the only restriction being as to the number of books in the hands of the newspapers at once. He believes that by thus being liberal with the papers they in turn will be liberal in their treatment of the railroads. These pass books and the space occupied in the papers are not debited and credited to the operating department.

Mileage books are issued to the newspapers by the Rochester & Eastern Rapid Ry. These can be used by any one connected with the paper and are renewed on request. The operating department charges the mileage to the respective papers and credits them for space used by the company. At the end of the year the accounts are balanced and carried forward into the next year.

Mr. Fassett said that in his opinion all free transportation, excepting to employes, should be done away with by members of the New York State association. At Albany, where policemen and firemen are required to pay regular rates, the plan has worked out very successfully and is bringing good results.

Before introducing the subject of interchangeable mileage, President Danforth stated that the time was ripe for adopting some kind of a ticket that could be used on any of the lines of the member companies of the association. He said that in view of the increased travel on the Ohio, Indiana and Illinois railways since the adoption of the interchangeable mileage, it would be well to consider the forms used in these states.

J. H. Pardee, who has made a study of ticket systems sanctioned by the Interstate Electric Railway Association and the Ohio-Indiana Railway Association, read the following paper, in which he recommends that the interurban railways of the state of New York issue an interchangeable coupon ticket book:

Interchangeable Mileage.

BY J. H. PARDEE, MANAGER ROCHESTER & EASTERN RAPID RY.

During the past few years many of the principal cities and villages in this state have been connected by interurban electric railroads, and in a few years more the present gaps will be closed and through electric train service will be possible from New York to Buffalo, as well as along the through lines of travel in the southern part of the state. Commercial travelers find electric roads quicker and more convenient than steam roads and as the electric lines are extended they will be patronized by commercial men more and more. Each electric railroad has its own basis and system of fares, and while the basis and system are not the same on all roads, yet there is a considerable uniformity and practically all of the electric lines are approximately on the same basis

and system. A few of the electric lines are issuing and selling to their patrons books which correspond in theory to the mileage books of the steam roads. Some of the lines are issuing straight mileage books which are identical with the steam mileage books, and others are selling coupon books which contain certain numbers of five-cent coupons entitling the holder to five cents worth of transportation for each coupon contained in the book. It would seem that if an interchangeable coupon book, good on all of the interurban lines of the state, could be issued such a book would be appreciated by the traveling public generally and particularly by commercial travelers, and that increased business would naturally result.

Several of the interurban lines of Illinois last year formed an association called the Interstate Electric Railway Association for the express purpose of issuing interchangeable coupon books good on all of the roads joining the association. The roads joining, signed a contract covering all of the details of the issuance and use of a book which contains 120 five-cent coupons and which is sold at a price of $5. The settlement of the revenue derived from the sale of the coupon book tickets is taken care of as follows:

All foreign coupons collected by companies which are parties to this contract shall be mailed to the company issuing them not later than the fifth day of the calendar month following the month in which they are honored. A statement shall be rendered for the coupons so sent on a basis of 83 1-3 per cent of their face value, a duplicate of which statement shall be forwarded by the same mail to the chairman of the association, and a remittance for this statement, if correct, shall be made by the issuing company not later than the tenth of the same month. Provided, however, that the settlement between two companies, each of which has mailed a statement to the other for the same month, shall be made by a payment of the balance.

The conditions attached to the coupon books and made a part of the contract for selling provides substantially as follows: The holder of the book is entitled to receive an aggregate of $6 worth of transportation. The selling company acts only as agent for the sale of such transportation as may be used over the lines of any other company. Coupons must be detached by the conductor. Sufficient coupons at their face value shall be detached to cover the local cash fare and not less than two coupons shall be accepted for any distance. Baggage can be checked only under the rules of the company over which the ticket is used. The book expires one year from date of purchase. The ticket is a bearer ticket and is good for the use of any one person and the person presenting the book shall be considered as the owner thereof.

Fifteen of the interurban lines of Ohio and Indiana formed a similar association called the Ohio-Indiana Railway Association, for the issuance and sale of interchangeable coupon tickets. The books issued by this association and sold by the subscribing companies are on the same plan as the Interstate Electric Railway Association, except that the books contain 240 coupons or $12 worth of transportation and are sold for $10. The conditions attached to these books are more severe than those attached to the books of the Interstate Electric Railway Association in the particulars that the book is good only for the transportation of the purchaser and that the purchaser must identify himself or herself by writting his or her name on the back of the coupon strip attached. The roads comprising the Ohio-Indiana Railway Association, as I am informed, make monthly settlements for tickets sold and redeemed through the equivalent of a clearing house.

You will notice that the reduction of the rate of transportation is equivalent to 16 2-3 per cent and the writer has had the rate sheets of several of the New York State interurban lines analyzed and finds that this reduced rate nets approximately the rate of round trip tickets. In other words, the holder of one of these books will be enabled to receive one-way transportation at approximately the same rate as the round trip transportation. The recommendations of the writer are that the interurban lines of the state of New York join in the issuance and selling of an interchangeable coupon ticket book which will contain 240 five-cent coupons at the rate of $10, subject to the following conditions: That the book is good for one year. That the book is good in the hands of any person and for any number of persons. That there shall be detached sufficient coupons at their face value to equal the one-way ticket rate. That not less than two coupons shall be detached for any distance, however short. That tickets shall not be good for the transportation of baggage unless permitted by the regulations of the company over whose lines it may be used. That expired or unused coupons may be redeemed only by the company issuing them if presented within 18 months from the date of issue, but only on the following basis: Full fare or face value shall be computed on all of the coupons which shall have been used. The balance of the original purchase cost shall be the value of the redemption.

The writer would recommend that the system of monthly settlement by the different companies be the same as pursued by the Interstate Electric Railway Association, that is, that each road receives or remits balances with every other road. These coupon ticket books as issued by the associations named are in the same form as the steam road mileage books, and cost from six to seven cents each in lots of one thousand.

J. N. Shannahan, Fonda, Johnstown & Gloversville Ry., asked as to the advisability of limiting the time for the usage of the proposed tickets. He was in favor of placing as few restrictions as possible and thought the traveling public would agree with him. Mr. Pardee and others expressed similar views.

The advantages of adopting a ticket as proposed were freely talked of and Mr. Pardee stated that the electric lines will be patronized more freely when an interchangeable book is adopted. The form recommended does not interfere with the commutation books now sold by some of the companies. It was voted that a committee of three be appointed to study the question, take up the matter in detail with each interurban company and submit a report at the annual meeting of the association in June.

When the association was called to order after the noon intermission, John N. Connelly, president of the Elmira Chamber of Commerce, gave an address of welcome and extended the hospitality of the city to the visitors. He paid several compliments to interurban railways in general and to those in New York state in particular and invited the association to hold its next annual meeting at Elmira. President Danforth responded to the address of welcome on behalf of the association.

E. J. Wilcoxen, Rochester Railway Co., opened the discussion on "Collection and Registration of Interurban Fares." He said that this is an important subject, but that he was hardly able to describe a system which would wholly protect a company's interests. He described the method used on the Rochester & Sodus Bay Ry., where Ohmer registers are used, with the two-collection scheme whereby a registration of the through traffic is rung in twice, stating that this scheme has proved very satisfactory. The association then talked of the merits of registers and of the methods by which they can be "worked."

Mr. Pardee stated that the Rochester & Eastern Rapid Ry. is getting good results from selling tickets at the rate of one and a half cents a mile and charging two cents a mile for cash fares. By this plan 87 per cent of the travel is with tickets purchased at the offices. Mr. Allen said that on the Utica & Mohawk Valley Ry. 64 per cent of the interurban collections passed through the ticket windows. On the Schenectady Ry. only a small per cent of the total receipts are collected at the stations. The fare question brought out much discussion favoring the offering of inducements to increase the ticket-office sales and thus reduce the opportunities for dishonest employes to steal from the company. This is one of the arguments to be offered for the adoption of the interchangeable tickets.

T. W. Wilson gave a description of the system of collecting fares in Montreal, Canada. The cars used there have one entrance and two exits. The "coffee-pot" system of collection of fares is successfully used. The people have been educated to the system and now always have their fare ready to drop in the box upon entering the car and as a result no trouble is had with collections.

The scheme of "pay as you go" is soon to be tried in Buffalo. A new 32-ft. car with a 7-ft. rear platform is now being built for the trial. It is intended to have the passengers enter the rear door and leave by the front door. The conductor will collect the fare on the rear platform before the passenger enters the car. The advantages of this system are many and the conductor is always at his end of the car to aid in preventing accidents. An effort will be made to educate the public in the use of the new system and to "step lively" on entering and leaving the car. In Montreal the

earnings have increased and the accidents decreased since the system was inaugurated.

City Schedules.

The subject, "City Schedules," was discussed at length by the men connected with the operation of city lines. President Danforth said that the proper arrangement of city schedules is one of the most intricate subjects confronting the operating departments. The schedule requirements vary in cities from day to day and it is necessary to change the schedules as the travel changes. Mr. Fassett described the new schedule in Albany which tends to distribute rather than concentrate the travel. A system of transfering which keeps the traffic as much as possible from the down town district is now in use. During the rush hours extra cars are operated between the center of the city and the suburbs and the regular schedule time is maintained.

In Rochester, according to Mr. Carver, a daily check is kept on the earnings of the various cars. If it is found that a stated run is showing a decrease in its earnings a man is sent to inquire into the cause and invariably it is necessary to change the schedule, setting the car ahead or behind as the case may require. By the checking system the company also is able to tell which runs are bringing in the money. It is often necessary to change the schedules daily until an increase is shown. This company operates only a small number of "trippers," nearly every car carrying a number and running on schedule time.

In Syracuse the conditions are such as to make it necessary to divide the schedules into day, early, late and strictly late runs. The operating department looks after the varying traffic very closely and changes the schedule whenever it can be made more satisfactory. Superintendent Duffy stated that the local conditions should at all times govern the making of the schedules.

Methods of Discipline.

Julian Du Bois, Fonda, Johnstown & Gloversvile Ry., next read a paper on the methods of disciplining employes. Discipline should begin when a man first enters the barn and should always be in force. Reprimands, suspension and discharge are the three fundamental principles of discipline. On the Fonda, Johnstown & Gloversville Ry. the Brown system with record blanks is in use. By this means the record of each employe is always before the superintendent.

Mr. Duffy stated that he believes moderate rules should be made and when an employe is reported for an infraction of the rules he should be given a hearing, as a personal talk with the superintendent often does a great deal of good. If an employe has a grievance he should have the right to appeal to the superintendent. Entering saloons, drinking, dishonesty and disobedience should call for immediate dismissal.

On the Schenectady Ry. new motormen are first sent to the shops to work, then they are sent out on the road under expert motormen and are not given a run until they have a thorough knowledge of the car and its equipment. In Toronto, Mr. Wilson said, a large number of trained motormen, known as roadmen, are detailed to do inspection work while on the road. They are placed on regular runs and have the authority to change cars with any other motormen on the system. In case of accident or trouble with defective equipment the roadmen repair the trouble and return the car to the barn. Good results are obtained from this practice. In Albany 38 inspectors are employed on the 80 miles of track. These men are not assigned to regular runs, but devote their attention entirely to the car troubles and to obtaining witnesses in case of accidents. In Schenectady inspectors are placed at congested points during the rush hours to aid in keeping the cars under headway.

Station Rules.

E. J. Ryan read a paper on station rules, in which he set down a number of rules to be rigidly enforced. The paper was referred to the association's rules committee for its consideration in view of its adoption in general among the railways of the state.

The operation of the Taunton & Buzzards Bay street railway has been discontinued between Middleboro and Monument Beach. It is stated that the present income of the road was not sufficient to pay operating expenses.

A Recent Traction Merger at Chattanooga, Tenn.

It has been reported that at a recent conference held in Chattanooga, Tenn., between parties representing Philadelphia, Boston, New York and Baltimore capitalists and officials representing the street railway interests of Chattanooga, arrangements were made to close the negotiations merging the properties of the Chattanooga Electric Railway Co., the Rapid Transit Co. of Chattanooga and the Chattanooga Electric Co., formerly the Chattanooga Light & Power Co. At this conference, it was decided that the syndicate of capitalists represented by Howard S. Graham of Graham & Co. and F. H. Monks, an engineer of Boston, Mass., should control the street railway properties of the city and that the name of the consolidated properties should be changed to the Chattanooga Railways Co.

By the terms of the merger, there has been placed on deposit $500,000 which is to be used in improving the consolidated properties. The merger will not only include the consolidation of the properties previously mentioned, but also takes in the lease on the Belt railway which was leased by the Rapid Transit Co. several years ago. It also includes the properties of the former Lula Lake & Lookout Mountain Ry. which operates the incline and electric line on Lookout Mountain.

In the consolidation of the properties, it is possible that plans will be devised by the new owners to either build a new incline up Lookout Mountain, or rebuild the old incline in order that freight may be hauled to the town which is on the mountain.

The Brooklyn Rapid Transit Co. Issues a New Publication.

The Brooklyn Rapid Transit Co. has recently issued the first number of a publication known as "The Third Rail," which is intended to serve as a medium for fostering a closer relationship between the employes of the Brooklyn Rapid Transit Co. and their employers. It is also intended to be a common meeting ground for the expression of the opinions of the employes on all subjects of interest to them that can be discussed within the confines of its columns.

This first issue contains, among other interesting articles, a brief description of the benefit association of the Brooklyn Rapid Transit Co. and the monthly report of the association, in which a full financial statement is presented. There is also an article entitled "Some Don'ts for Motormen" which we are pleased to reprint herewith:

Some Don'ts for Motormen by 3161.

Don't take for granted that because a facing switch is rarely used that it will never be carelessly left open.

Don't pass a woman because she is on the wrong side of the street. She probably only reads the fashion news in the papers.

Don't blame the conductor if he gives you a "stop" bell after giving you the "go ahead" signal. It is probable that some woman just happened to remember her "objective point."

Don't argue with an inspector. If you are sure you are right, go to the "man higher up."

Don't drink "hard stuff." It will make you wear old clothes and it is bad—morally, physically and financially.

Don't leave your car to turn a switch without locking your controller. Curiosity in the traveling public still exists and serious results may ensue therefrom.

Don't "chew the rag" at the expense of the company; they may retaliate.

Don't think the starter is your worst enemy because he won't let you off. There may be a reason beyond your capabilities to account for.

Don't try to catch up to your leader because you are behind time; you can't pass him.

Don't try to make two motors do the work of four; the car "ain't built that way."

Don't trust too much to chance or good luck in speeding your car in lonesome places.

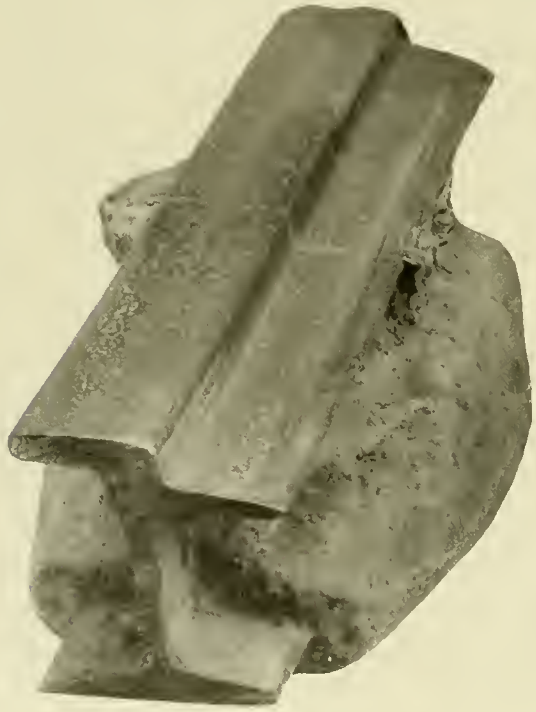
Don't feed your controller fast when you are late; you don't gain by it. They are made to do certain work and they are not human, and so cannot be forced.

Some Interesting Results of Cast-Welding Rail Joints.

The question of general track repairs and more particularly that of the maintenance of track joints, has been of considerable importance from the day of the first tram rail track and steam locomotive. It is a well known fact that the rail joint is the weakest part of a track and numerous methods of fastening the rail ends have been devised to remedy this weakness. For years the 30 and 32-ft. rail were standards with the joints placed opposite or "staggered" according to the opinion and judgment of the engineer in charge. It is claimed that by "staggering," the life of the joint is doubled by the halving of the blow.

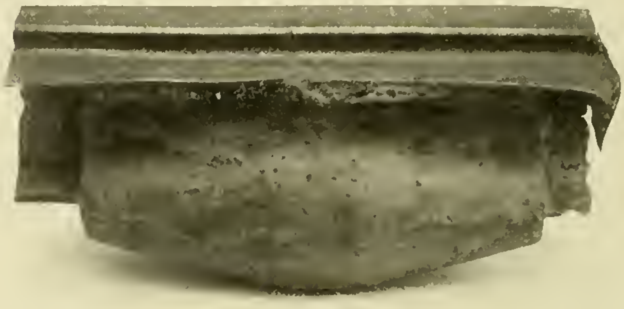
The rolling of rails in 45 and 60-ft. lengths in recent years has reduced the number of joints, thereby increasing the life of the track and reducing the maintenance expense. But this has its objections in the opening and breaking of joints, due to contraction in cold weather, and the difficulty of maintaining alignment in the hot seasons. The supporting of joints by ties placed directly under the center of the joint, has been largely adopted to remedy the trouble. The mechanical, bolted joint has passed through various stages of development, from the plain flat fish bar to the later types of truss and underplate joints. Several have reached a state which seems to fulfill as near as possible all requirements with a minimum cost of maintenance.

It is also generally known that the wear and final breaking down of a joint is due to the loosening of the bolts and that the pumping motion produced by the heavily loaded cars operating over them will take place under the most favorable conditions and methods of construction. An examination of a joint that has been in use for some time, will, in many cases, reveal a groove of more or less width and depth on the under side of the ball and in the top of the flange or the base of rail where the fish-plate or angle-bar has had its bearing. This wear is generally greater on the "receiving rail" of a double track, but is more uniform in the single-track system. Attempts have been made to remedy the trouble by the removal of the old joints and the substitution of a different type, even resorting to the expedient of using special angle-bars with offsets to support the receiving rail. Because they support the rail at other points than do the old bars, the new bars hold the joints in place for a time and prove quite satisfactory, but in time the new joints become seated in the old grooves earlier referred to and, with the loosening of the bolts, the pumping action is resumed. The wear of the ties further increases this action and it is only by the occasional substitution of new ties that the situation is helped. The foregoing applies to all railroad construction, either steam or electric, city and interurban.



PERSPECTIVE VIEW OF JOINT.

The question of expansion and contraction of rails is of considerable consequence in the open, exposed tracks of steam and interurban electric systems, particularly with the heavy sections of the 75 to 100-lb. rail now used. But this item is of much less importance, in fact is almost inconsiderable on city railway lines where the rails are imbedded in the pavements. Even with the deep 9 and 10-in. girder sections, with a top surface of five inches exposed, the expansion and contraction are not enough to be given consideration.



CAST-WELDED JOINT RECENTLY IN SERVICE IN THE TRACK OF THE MILWAUKEE ELECTRIC RAILWAY & LIGHT CO.

So far the steam roads have to be satisfied with the improved bolted joint or angle-bar, but with the city electric systems the objections to and the defects of the bolted joint have been largely met by the cast-welded joint.

From the nature of the construction of the cast-welded joint, it is evident that no matter what the wear on the head or flange of the rail may be, the metal when poured will fill the worn grooves and uneven surfaces and unite with the metal of the rail. When this is properly done, a continuous line of steel will be formed with its hitherto weakest points made even stronger than the main rails. Because of the large amount of well distributed metal used in the making of this joint, the truss effect with its resistance to deflection or bending under heavy loads, is obtained.

Another valuable feature of the cast-welding process is the production of a joint with equal and in many cases greater conductivity than the running rail. This is not so readily obtained with the bolted joint and bond wire construction.

The life of the cast-welded joint is longer than that of the rail and, when once installed, the maintenance charge is small. This fact, together with the other advantages previously mentioned, enables a company to put its worn-out track in good condition and perhaps save large reconstruction accounts and in addition enable them to reach out into new territory with lines they otherwise could not afford to build.

A good illustration of the rehabilitation of a heavy-service line by the introduction of the cast-welded joint is found in the Farwell Ave. line of The Milwaukee Electric Railway & Light Co., Milwaukee, Wis. This is the principal line of the city and operates between 35th and Wells Sts. on the West Side, through the heart of the city, to Lake Park and points beyond on the East Side. The East Side car house, one of the largest in the city, is located on this line, and this, together with the fact that it is the popular resort line, makes the service heavy.

The Jackson St. portion of the Farwell Ave. line was originally laid in September, 1891, with a girder tram rail five inches high with a base three and a quarter inches wide and a head two and a quarter inches wide and one inch deep next to the tram. The tram is one and seven-eighths inches wide and the weight of the rail is 58 lb. per yard. The track was laid on cedar ties 6 x 6 in. x 7 ft. in size, laid 2 ft. 6 in. between centers and ballasted with the material of the natural roadbed which consisted of macadam and dirt. The rails were in 30-ft. lengths and were spliced at the joints with the ordinary light fish-plate bars. The joints in time became very badly pounded down and there was so much movement to the rails that the car wheels would strike the receiving rail about four inches from the joint, the rail at that point becoming much hollowed by the constant hammering.

This track was operated over until 1897, when a contract was made

with the Falk Co., Milwaukee, Wis., to cast-weld the joints. Great care was necessitated in the welding process, because of the excessive wear, but the results were most satisfactory, as was shown by subsequent events. The track, as welded, was used until October, 1905, when it was removed and replaced with a heavy high T-rail, designed by President John I. Beggs of The Milwaukee Electric Railway & Light Co., to comply with the city requirements in regard

VIEW SHOWING A CAST WELDED JOINT IN SERVICE.

to the new asphalt pavement. Until the time of reconstruction the old rail had given a total of 14 years' service, during eight years of which the welded joints were used.

The accompanying illustrations are views of an average joint removed from the Jackson St. track near Mason St. The general perspective view shows the section of the rail and the style and the smoothness of the joint. Another gives a view from the back of the rail and shows to what extent the hollow in the receiving rail has been "ironed out" since the joints were welded.

METHOD OF POURING A CAST-WELDED JOINT.

The Farwell Ave. line was put in operation in October, 1891, with single-truck cars having 18-ft. bodies and wheels with a 2-in. tread and ⅝ x ¾-in. flanges. These cars were replaced in 1896 by 41-ft. double-truck, four-motor cars, weighing about 40,000 lb. each with wheels having a 2¼-in. tread and a ¾ x 1-in. flange. The headway of cars over this line has averaged five minutes during the 14 years that the rail has been in service, not including extra and car-house runs. Under this heavy service, the head of the rail became worn down about ¼ in. and the joint shows that the wheel flanges were running on the tram of the rail. As shown in the illustration, the head of the rail is smooth and perfect, while the tram, for a space of 11½ in., is grooved out to a depth of about ⅛ in.

This case illustrates the practicability from the standpoints of efficiency and economy in saving the old track by the use of the cast-welded joint. That these joints have lengthened the life of this particular track for at least seven years and postponed a reconstruction expense for an equal time is a fair assumption. It is also fair to assume that they have reduced the maintenance account to a small amount and have saved wear and tear on the rolling-stock which is a considerable item. At the same time they have added to the comfort of the riding public.

The Milwaukee Electric Railway & Light Co. is making a practice of cast-welding all joints in both old and new track. The company has about 150 miles of track in operation.

The Sixth Annual Meeting and Banquet of the New England Street Railway Club.

The sixth annual meeting and banquet of the New England Street Railway Club was held at the Hotel Somerset, Boston, Mass., on Thursday, March 22nd. The business meeting was held during the afternoon, the following officers being elected: President, Paul Winsor, Boston, Mass.; vice-presidents, H. E. Reynolds, Boston, Mass., L. Bentley, New London, Conn., E. T. Millar, Concord, N. H., W. E. Robertson, St. Albans, Vt., Myron A. Webber, Westerly, R. I. and F. C. Farr, Brunswick, Me.; secretary, John J. Lane, Boston, Mass.; treasurer, N. L. Wood, Boston, Mass.; executive committee, E. E. Potter, New Bedford, Mass., E. P. Shaw, Jr., South Framingham, Mass., M. C. Brush, Newtonville, Mass., W. H. Blood, Jr., Boston, Mass., F. M. Nellis, Boston, Mass., E. L. Janes, Boston, Mass., and Charles B. Price, Boston, Mass.; finance committee, Paul Winsor, John W. Corning and P. W. Davis, all of Boston, Mass.

At the close of the business session, Mr. B. V. Swenson, secretary-treasurer of the American Street & Interurban Railway Association, addressed the members on matters relating to the American associaton.

Secretary Swenson outlined the rise of the American Street & Interurban Railway Association and its affiliated associations and stated that all of the affiliated associations had adopted new constitutions since the reorganization. It has been considered best that the Accountants' association and the Claim Agents' association should not allow their membership to extend beyond the member companies of the national association. The Railway Engineering association has two classes of members, including active members, consisting of the member companies of the American association and individual members, consisting of associate members of the American association who receive all the advantages to be derived from both the Railway Engineering and the American associations.

There has been a change made in the payment of the annual dues by the various member companies. Prior to the reorganization, the yearly dues payable by those holding membership in the four organizations were $70. Of this amount, the American association received $25, the Accountants' association $20, the Mechanical and Electrical association $20, and the Claim Agents' association $5. For various reasons, it had been decided that the most satisfactory way of determining the amount which each company should pay as a yearly due, was to base it upon the annual gross receipts of the company. For companies whose receipts are under $50,000, the rate is $15 per year and for companies whose receipts are $10,000,000 and over, the rate is $600. The intermediate companies are rated proportionately. It is expected that upon this basis the association will receive approximately $20,000 a year.

Mr. Swenson then spoke briefly of the work which the allied associations now have in hand, and said that the program which was outlined at the Philadelphia convention is being successfully carried on. Many applications for membership are being received and 57 new companies have joined the association. He said that very few companies had signified their intention of discontinuing their connection with the association. He thought it quite necessary that all the companies which were formerly members of the American Street Railway Association should continue to support the new association.

In the evening a banquet was held at the Hotel Somerset which was attended by about 350 of the 625 members of the New England

Street Railway Club. This was the largest gathering of the kind in the history of the club. President Paul Winsor presided and introduced as the toastmaster of the evening, the Hon. Russell A. Sears, attorney for the Boston Elevated Railway Co. The speakers included Hon. W. Caryl Ely, president of the American Street & Interurban Railway Association; Hon. Samuel L. Powers, of Boston; Hon. Charles F. Libbey, president of the Portland Street Railway Co., Portland, Me., and Hon. Fuller C. Smith, of St. Albans, Vt., chairman of the Vermont Railroad Commission.

Mr. Ely delivered a very interesting address. He said that he had always strongly advocated the supervision of railways by boards of state commissioners as such supervision greatly benefited the various roads. He thought that the movement for municipal ownership of street railways that had been started elsewhere was probably due, more than anything else, to the fact that such boards had not been established in these localities. In the states where government control of street railways exists, the roads have in general been better managed. Mr. Ely said that the results obtained by the National Civic Federation in its study of the problem of municipal ownership had been somewhat misrepresented and that if a fair comparison had been made between cities in other countries, of the same population and under the same conditions that exist in cities in this country where municipal ownership had been tried, that the results would be found in favor of private ownership. He did not think that under the present political conditions existing in such cities as New York and Boston, that the street railways could be operated to advantage under municipal ownership.

PAUL WINSOR.

Mr. Ely then spoke of the work which the steam roads are doing in the electrical equipment of their properties, and which he believed will do much in the future towards solving the transportation problem. He outlined a system of transportation for steam roads which is practically as follows: A trunk line for long hauls of passengers and freight; a light railway system for towns and villages lying along these trunk lines and street railways for the local transportation in cities and towns which will connect the railroad stations with the other lines.

Mr. Paul Winsor, the newly elected president of the New England Street Railway Club, is a street railway man of marked ability, being chief engineer of motive power and rolling stock for the Boston Elevated Railway Co., Boston, Mass. Mr. Winsor is a native of Massachusetts. His connection with the street railways of Boston began in 1894. For some nine years prior to that time he was connected with the electrical interests in Pittsburg and St. Paul. He has a particularly genial and democratic personality which has won for him many friends and has made him one of the most popular street railway men of New England. The New England Street Railway Club is to be congratulated upon having Mr. Winsor for its president.

The Tri-State Tourist.

The first number of the "Tri-State Tourist," which is a monthly publication issued by the passenger department of the Boston & Northern and Old Colony street railways, has been received.

The first issue is dedicated to the general public and the paper is intended for the public's education and entertainment. Short sketches will be given from time to time of many of the historic towns and houses along the lines of these two companies. There will also be much interesting matter written in a lighter vein. The paper will be printed in such a manner as to appeal to trolley tourists who are unfamiliar with this electric system, which reaches many cities, towns and villages in Massachusetts, Rhode Island and Connecticut.

The City Electric Ry., of Port Huron, Mich., has closed a contract to carry all of the express matter handled by the American and Canadian express companies, from the portal of the tunnel under the St. Clair River to the down town offices.

The Wisconsin Brake & Electric Co.

The Wisconsin Brake & Electric Co., has been recently organized to take over the plant and assets of the National Electric Co., Milwaukee, Wis., which was bought in a short time ago for $500,000. The incorporators are: W. D. Hickman of Milwaukee and J. A. McCormick, and Carl W. Boehm, who are said to represent the interests of the Westinghouse Co. of Pittsburg.

The National Electric Co., it is said, will continue as a progressive concern of Milwaukee. It is also said that several important developments of the Westinghouse Co. will be transferred to the National Electric plant with the result that the business of the company and the number of its employes will be greatly increased.

Preliminary Announcement of the 1906 Convention of the American Street & Interurban Railway Association.

Secretary B. V. Swenson has announced to the members of the American Street & Interurban Railway Association and to the members of the allied associations that the annual convention will be held this year at Columbus, O., during the week of October 15th to 20th. This announcement has been mailed to all the members of the various associations and is as follows:

Place of Meeting.

The annual convention of your associations will be held in the city of Columbus, O., the week of Oct. 15 to 20, 1906. The days upon which the different associations will hold their meetings have not yet been definitely decided, but this matter will be given attention at an early date.

The executive committee of the American Street & Interurban Railway Association considers that it is highly desirable to hold the next convention in one of the interurban railway centers in the middle West. Special committees of the American association, and of the Manufacturers' association were appointed to consider this matter and to decide upon the location of the 1906 convention. After a careful investigation, which included visits to various cities, Columbus was the unanimous choice of the committees. It affords most excellent facilities and is admirably located for the purposes of the association.

Hotels.

Columbus is the state capital and has successfully taken care of many large conventions. It possesses four large well-appointed hotels, as well as several first-class smaller ones which collectively can guarantee about 1,100 rooms, many of these with bath, if desired. The rates for one person, on the American plan, vary from two dollars upward, and on the European plan, from one dollar upward. Those who desire to do so can make reservations now, by addressing B. H. Harrison, Secretary Convention Committee, Columbus Board of Trade, Columbus, O.

Exhibit of the Manufacturers' Association.

Most excellent facilities have been provided for the Manufacturers' exhibition, which has become such a feature of the national street railway conventions. The exhibition halls are located on the State Fair Grounds, which are within 15 minutes' ride of the principal hotels. There are six adjoining brick exhibition halls; four buildings, 110 x 200 ft., and the other two, 100 x 150 ft. In addition, there are three covered sheds with brick pavements, 100 ft. wide by 400 ft. long. The Manufacturers' association will have a larger and more comprehensive exhibit than ever in the past. The Big Four R. R. tracks will be run directly up to the buildings.

Convention Hall.

The assembly or convention hall is 80 x 100 ft. in size, comfortably seating from 600 to 800 people, and is in close proximity to the exhibition halls. If desired, one of the six buildings can be used for the convention hall, with a seating capacity of 1,500 people. All of the buildings can be heated by natural gas and can be lighted by electricity. Sufficient power to operate exhibits will also be available, both 500-volt, direct current and 110-220-volt, 60-cycle alternating current.

Convention Committee.

President Ely has appointed a convention committee which will have these general matters in charge, and a second announcement containing more specific details of the convention will be issued within a short time.

Handling Railroad Scrap.*

BY W. G. TUBBY, GENERAL STOREKEEPER, GREAT NORTHERN RY.

With the exception of a few articles, all scrap that accumulates on a railroad has a market value, so that it is of the utmost importance that it be taken care of and turned over to the store department with the least possible delay, to be sorted out, the second-hand usable parts to be taken into store, material that can be repaired to be taken to shops, and the balance graded and placed in bins for sale. The labor involved in handling scrap is expensive, because it is slow work sorting out second-hand material that can be repaired or that is usable, from that which is actually scrap and of no further use, and grading it for sale.

At the new Great Northern shops and stores, recently erected at Dale St., St. Paul, the location of scrap bins and the kind of scrap bins to be built was given a great deal of attention, so that scrap received from the shops or shipped in from different points on the line could be handled with the least possible expense. On the Great Northern system all scrap is turned over to the store department as soon as made, or as soon after as convenient, and the proper accounts credited with the value of same, so that all scrap on the entire system is cleaned up each month. Maintenance-of-way scrap that has accumulated at the section tool houses during the month is picked up by the supply cars.

Shop scrap is handled as follows:

All scrap brass is delivered to the storehouse by the mechanical department, with credit ticket made out as fast as it accumulates, and credited to the proper account. On receipt of the scrap brass at the storehouse it is weighed, graded and put in the bins assigned for same, which bins are located in the storehouse, and are kept locked.

The heavy scrap from the machine shop and all from the blacksmith and boiler shops is loaded on cars specially assigned for scrap service at the shops as it accumulates. Credit tickets are made out and turned over to the store department, which has the cars switched to the scrap bins to be unloaded, sorted and graded, and the scrap received is checked against the credit tickets turned in, so that all scrap is credited to the accounts for the month in which it belongs. In this way there is no scrap left scattered around the shops or grounds.

On account of locating the west end of the scrap bins convenient to the door of the machine shop, all turnings and borings and all scrap that can be handled by push car or wheelbarrow are delivered by the mechanical department to the scrap bins with credit tickets daily, and only the large kinds, such as wheel centers, cylinders, etc., are loaded on scrap cars assigned for that purpose; but all scrap from the boiler and blacksmith shops is loaded on scrap cars and delivered to bins for sorting and grading. This is both a convenient and economical arrangement.

At smaller shops all scrap is delivered to the store department daily and credit tickets to the proper accounts turned in on delivery. At locomotive roundhouses and car repair yards the scrap is delivered to the storehouse bins with credit tickets, at the time the requisitions are made for new material; so that the man who delivers scrap to the storehouse sees it weighed and takes the new material back with him.

In the case of car repair yards being located too far from the storehouse to deliver the scrap as removed, it is allowed to accumulate until a certain date each month, when it is weighed and loaded on cars, and turned over to the store department with credit tickets; but in all other cases all scrap is delivered to the storehouse at the time new material is drawn. Scrap journal bearings, however, are delivered to the store at the time new journal bearings are drawn, so that there is always a scrap bearing received when issuing a new one.

All maintenance-of-way scrap, with the exception of rail, is delivered to the supply cars when making their monthly trips at the time the new supplies are delivered. The scrap which has accumulated on the sections during the month is assembled at the tool houses from time to time and the section men are instructed to sort out the different kinds, so that on arrival of the supply cars the different kinds of scrap are quickly weighed and loaded, and credit tickets made out in duplicate and O. K'd. by the section foreman and supply car man, the original being sent to the division superintendent for his information to invoice against the store department for the amount and value of the scrap turned over to the supply cars, and the duplicate sent to the store-keeper to check against the scrap received on the car when it arrives and also to check against the superintendent's invoices when received. In this way there is no confusion or misunderstanding. The store department receives the scrap and accepts the superintendent's invoices for same.

When the supply cars are loaded with scrap they are billed to the storehouse from which they are operated, and another empty car is started out. All track scrap, including frogs, crossings, split switches, switch stands, hand and push cars, tools, etc.—in fact all scrap with the exception of rail—is cleaned up each month and loaded on the cars which accompany the supply cars delivering the monthly supplies. In this way all the scrap on the system is shipped to the stores each month with the exception of scrap rail, this being loaded by division superintendents as often as convenient.

In order to get the best results in handling scrap, it is essential that all concerned be educated to the fact that the different parts must be separated, the usable from what is actually scrap, and the cast or malleable from steel, wrought, etc., as each kind of scrap has a different market value; and also that all scrap must be turned over to the store department as soon as possible and credited to the proper accounts. Also, the store department should insist on old tools and other material being turned in, so far as can be done at the time new material is issued. By this method all scrap is in the hands of the store department practically as soon as it accumulates, when it is sorted, graded, and the usable material separated and put into stock for further service, and the scrap sold at the option of the purchasing agent.

The question of handling the scrap after being received, in order to produce the best results at the least possible expense, which includes sorting out second-hand usable material and material that can be repaired at a cost that would warrant doing so, in preference to scrapping, is a very important one. In the first place, a thoroughly competent foreman, who has a good knowledge of the different kinds of usable material and its use and the grades of scrap, should be assigned in charge of the scrap bins; and steady and intelligent laborers should be assigned him. These men should not be taken off the work so long as there is work to do, as they only become efficient by long experience. It is also advisable and economical to pay one or more of the old, experienced men a few cents per day higher rate than the other laborers with whom they are working, in order that they may be relied upon to retain their positions and watch the other men and see that usable material is not being scrapped or scrap not correctly graded, which is of great importance when loading on sales orders.

To handle scrap economically a proper system of scrap bins should be provided, the floor of the bins being on a level with the deck of cars, and the bins of sufficient capacity to meet all requirements. The bins in the Great Northern shops are 600 ft. long by 38 ft. wide, which includes a platform on one side 8 ft. wide, on which is located a standard gage track for the operation of push cars which are used in moving the different kinds of scrap for delivery to the proper bins. On this platform, in front of the bins, are two track scales on which to weigh the scrap loaded on push cars, which is a convenient and economical arrangement. All cars containing scrap from shops or shipped in from different points on the line are unloaded onto push cars on this platform for delivery to the bins after being weighed.

On the opposite side there is no platform, but a track is located where cars are placed at the bins for loading scrap on sales orders. By having no platform on the sales side, there is no lost ground to travel over in loading scrap into the cars, as would be the case if scrap was loaded on the sorting side. The tracks on each side of the scrap bins lead together at the ends. At the east end they lead to the track scales where all empty and loaded cars are weighed. This prevents delay while switching, as, if a switch is being made on the sales side, the men can be moved over to the sorting side and continue at work until the cars are placed for them to resume loading. Or, if the cars are on the sorting side, being switched, the men can be used in loading or moved over to the main storehouse, which is only a few feet distant, the scrap bins being located parallel to the main storehouse, and connections made at each end by swing bridges which can easily be turned by

*Extracts from a paper read at the January meeting of the Northwest Railway Club.

one man, and thereby kept at work at all times while switching is being done. The west end of the scrap bins is opposite to and only a few feet distant from the door of the machine shop, with a turntable at the end of the incline track from the platform, so that scrap can be loaded on push cars and run over to the incline, turned, weighed on the platform track scales and delivered to the bins in which the scrap is to be placed.

At each end of the scrap bins a number of bins have been roofed over, and in these bins are stored the different kinds of borings and turnings, Nos. 1 and 2 wrought, foundry, coke, sand and ashes, scrap hose, rope and sacking, and other scrap which should be under cover. The balance of the bins are uncovered.

In connection with the economical handling of scrap I would not recommend contract labor unloading, sorting and grading of scrap at a price per ton, for the reason that there is so much good second-hand, or material that can be repaired cheaply, which would be liable to be scrapped if paid for at a contract price, and the principal thing the contractor would have in view would be the tonnage. The best and most economical results are obtained by placing a competent, conscientious foreman in charge of the scrap yard, so that no material but what is actually worthless would be scrapped. The scrap pile furnishes an interesting and instructive object lesson, for there you find the remains of the material that has been purchased new and put into service by the different departments in the operation and maintenance of the road. By studying the breakage, the weakness and defects of the material taken out of service are located, and if necessary a remedy is provided.

Shop Notes from Fonda, Johnstown & Gloversville Electric Railway Co.

The repair shops of the Fonda, Johnstown & Gloversville Electric Ry., Gloversville, N. Y., are operated in connection with the shops of the steam road controlled by the same company. W. H. Collins, master mechanic of the steam line, is also master mechanic of the electric railway and is in direct charge of the repair work of the equipment. On account of the interesting methods used by Mr. Collins in combining the work of the electric repairing with that of the steam line, a description of these methods may prove of benefit to others.

The company operates its own foundry, in which are moulded its brake shoes, motor axle bearings and other castings used on its system of railways. This has enabled the company to experiment with its shoes in testing for different degrees of durability. As a result it has been found more economical to sacrifice a little cost in the moulding of new shoes of soft metal, thereby gaining greater braking power, than to use a harder shoe, although it may be of greater durability. The shoes now used cost 42.8 cents per 1,000 car miles, but this figure can be reduced considerably by making a harder shoe. The soft shoe, it has been determined, is more efficient as it prolongs the life of the wheel and reduces the possibility of collision because of its increased braking power.

Both brass and babbitt bearings are used on the high-speed cars. In the former the solid brass type of bearing is used. A close inspection of the bearings is made periodically and as soon as one is found to have worn on the collar end so that the waste motion endangers the safety of the pinions, it is removed and sent into the shop. Here the worn surface is trued up on a lathe, a brass collar ⅜ in. thick is copper riveted to the surface and the bearing is again put into service with its original wearing qualities. When this collar shows wear, it is replaced by another of similar design, the expense being very slight.

The repairing of the babbitt bearings is an important factor in the reduction of the maintenance expense. The outer surface of the babbitt shells, which are cast in the company's foundry, have the same dimensions as the solid stock bearings other than the thickness, which is ¼ in. less. A lip ¼ in. thick is cast on the inside edges of the metal and serves as a lock for the babbitt which is later run into the concave surface. Experience with this type of bearing, which costs $4.54 less per motor than the solid bearings, has shown that the life of the shell is greater than with the solid bearing and as the babbitt is replaced at a nominal expense whenever necessary, the weight of the motor is at all times distributed along the length of the journal. If the head of the bearing wears thin, a collar similar to the one previously described is riveted on to the head and the life of the shell correspondingly increased.

Mr. Collins has also a means of reducing the expense of keeping the journal boxes in good condition. The journals used by this company are of the M. C. B. 3¾ x 7-in. type. After the journal has been used for some time it is found that the end nearest the wheel hub has gradually been worn away by friction. Before the wearing process has been allowed to wear away the face of the journal it is removed and another substituted in its place. A steel plate of the required thickness, covering the entire surface of the worn end, is then riveted to it and the journal is again put into service. By careful tests and the renewal of the plate, it has been found that the life of the journal box can be prolonged indefinitely. According to the shop records, the cost of the plate and the labor of applying it is 58 cents. New journals cost the company $3.56 each.

A furnace in which to temper the elliptical and semi-elliptical springs used on some of the company's cars has been set up in one end of the blacksmith shop. When a spring is broken down the unbroken parts are mated with other parts made in the shop. They are then placed in an oven, burning hard coal or coke, and heated uniformly, after which they are tempered, tested and mated for further service. The oven is a somewhat crude affair, constructed of brick and occupying a small floor space. By the use of this oven the springs under the cars are kept in a good condition at a small expense.

When it is necessary to remove the wheels from a car axle where solid gears are used, the company has found it advisable to loosen and remove the gear. In order to press the wheel off without removing the gear, two heavy concave castings have been made to fit over the gear. One end of the casting is beveled to fit under the flange of the wheel and the other is left flat to give solid contact with the wheel-press. By the use of these castings, gears, when once set in place, are left until stripped or broken and the company is seldom troubled by their coming loose.

The card system is used in checking up the mileage of trolley wheels. When a wheel is put into service, it is given a number. A card is then filled out giving the number of the car on which it is placed, together with the day of the month. As soon as it is found that the wheel is arcing, it is taken to the shop with the card originally made out attached, and trued up on a lathe. When it is returned to the barns, the date on which it is again put into service is recorded. By watching the wheels closely and sending them to the shops as soon as they show other than true wear, the company is able to obtain good mileage records.

The Portsmouth, Dover & York and the Atlantic Shore Line Electric Railway Systems to Be Consolidated.

The announcement has been made that the Portsmouth, Dover & York and the Atlantic Shore Line electric railway systems will be consolidated. This consolidation means practically the building of the connecting line, 18 miles in length, between Kennebunkport and York Beach, and the coming into existence of an electric railway system including 100 miles of track.

The stockholders of the Atlantic Shore Line Electric Railway Co. also voted to increase the capital stock from $1,000,000 to $3,000,000. This will be divided into common stock to the amount of $2,000,000 and preferred stock to the amount of $1,000,000. An issue of bonds to the amount of $1,900,000 is authorized for the purpose of taking up the bonds of the two systems and for making improvements.

It is believed that a reduction in operating expenses will result since the surplus power from the water power plant of the Atlantic Shore Line Electric Railway Co. can be utilized to furnish power for the Portsmouth, Dover & York Co. The power alone costs the Portsmouth, Dover & York Co. $24,000 per year. It is stated that no change in the personnel of this company is contemplated. The establishment of a steamship line making daily trips from Boston to Portland and stopping at Kittery Point is also under consideration.

Concrete Bridges.

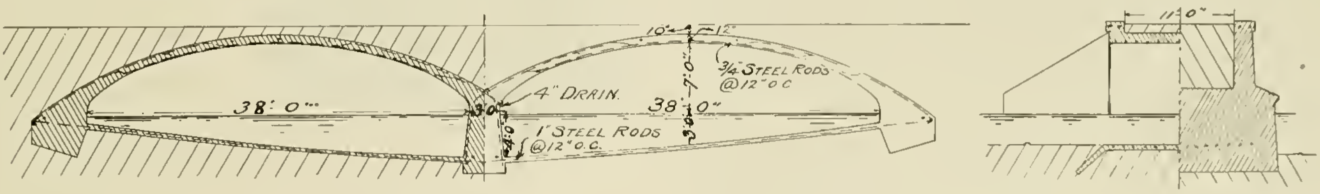
BY DANIEL B. LUTEN.

Interurban railways have been quick to appreciate the fact that for small culverts, concrete, plain or reinforced, offers many advantages over steel and timber girders in affording absolute permanence and a continuously solid roadbed, with economy in the first cost. But few engineers have recognized that reinforced concrete bridges can be built in comparatively long spans, at less cost than steel, and having besides all the advantages of the small culverts. With spasmodic famines in the structural steel market this becomes a most important consideration, even if all the other advantages of reinforced concrete be overlooked, when it is remembered that none of the materials required for reinforced concrete can cause any serious delays and are nearly always procurable in the local markets. Two bridges recently designed and erected by the National Bridge Co., Indianapolis Ind., illustrate the advantages of reinforced concrete in economy, appearance, and speed of erection.

FIG. 1.—TWIN-ARCH BRIDGE OF 38-FT. SPANS AT AUBURN, IND., ON THE TOLEDO & CHICAGO INTERURBAN RY.

Fig. 1 illustrates a twin-arch bridge of 38-ft. spans at Auburn Junction, Ind., on the Toledo & Chicago Interurban Ry. This bridge complete cost $1,950 and was erected in 35 days. It is designed to carry 75-ton cars operating at high speed besides the dead weight of the earth and concrete.

A longitudinal section of the bridge is shown in Fig. 2 and a transverse section in Fig. 3, the latter view being taken half at the crown and half at the middle pier. The bed of the stream is paved with concrete from abutment to abutment to render the bridge flood-proof, with aprons at both the up-stream and down-stream sides projecting downwards several feet to prevent undermining. The pavement is placed about one foot below water level at the abutments in order that steel ties embedded from abutment to abutment may resist the thrust of the arch, as near as possible to the springing lines. At the pier where the thrust of one arch is balanced by that of the other, the pavement is depressed to a level of four feet below water level. The arches are reinforced with ¾-in. smooth steel rods passing near the lower surface at the crown and near the outer surface along the haunches, and crossing the arch ring at the middle and third points of the half-arch, so that a single system of rods reinforces the arch against all possible tensile stresses and shear. These rods extend down both faces of the pier, thus reinforcing the pier against the moments that might be produced by a load applied on one arch with the other arch unloaded. A further stiffening of the arches against unbalanced loadings is effected by reinforcing the spandrels to resist the tendency of the unloaded arch to rise.



FIGS. 2 AND 3.—LONGITUDINAL AND TRANSVERSE SECTIONS OF BRIDGE AT AUBURN, IND.

This structure contains about 190 cu. yd, of concrete and 9,000 lb. of steel. The cost of the steel reinforcement in place was approximately 10 per cent of the contract price, but, for the arch alone and neglecting the steel ties embedded in the bed of the stream, this type of reinforcement rarely exceeds three or four per cent of the total cost. The steel bridge shown in Fig. 1 is a highway bridge supported on steel tubing on the thoroughfare that parallels the interurban line, and is designed for loads one tenth as great as the concrete bridge. The comparative simplicity of the latter is striking as will be seen in the illustration.

Fig. 4 shows a view of the East Washington St. Bridge in Indianapolis, over which pass the double tracks of the Indianapolis street railway system. The interurban cars of the Indianapolis & Eastern Railway Co., also use these tracks, including the heavy "Interstate Limited" cars running between Indianapolis and Dayton, O. This bridge is of a design similar to the Auburn Junction bridge but is a single span of 65 ft. with a roadway of 57 ft. between railings. The bridge is built on a skew of about 15 degrees across the full width of East Washington St. and the brick pavement, cement walks and curbs of that street are extended across the bridge. The contract price complete was $10,885.

The arch was constructed in concentric rings complete from abutment to abutment and traffic was carried by one-half the bridge and roadway during the erection of the other half. The continuous concrete railings were erected after the centers had been removed from beneath the arch, in order to give the arch its settlement under its loading without endangering the railings by cracking. The filling, pavement and sidewalks had all been completed prior to the removal of the falsework.

The copings and railings have a camber of six inches in the span of 65 ft. and drains are provided at each of the four corners to carry the surface water down through the arch. The bridge was begun in December and completed in April, requiring but three months of a severe winter. All steel used in reinforcing these arches was smooth and soft, readily procurable from any dealer in heavy hardware, and the joints were made by welds or by overlapping with open hooks.

Such bridges as these require neither painting nor repairing, will last indefinitely, increasing in strength with age, and can al-

ways be designed to accord with their surroundings. The solid roadbed makes it as easy to maintain the track-level at the approaches to these bridges as at any other point of the line and all adjusting of ties and stringers, guard rails and mud walls is dispensed with, as well as periodic inspection.

FIG. 4.—EAST WASHINGTON ST. BRIDGE IN INDIANAPOLIS.

Personal.

MR. ALBERT BENHAM, assistant superintendent of the Cincinnati Traction Co., has been appointed general superintendent of the Appleyard lines with headquarters at Columbus, O.

DR. MAURICE J. DOTY has been appointed the head of a bureau of transportation which was recently appointed by the Chicago City Council to look after all traction problems that may arise in the future.

MR. F. H. JAMESON, who, for the past two years, has been connected with the New York office of the Ohio Brass Co., has been appointed sales manager of the Chicago office of this company at 321 Dearborn St.

MR. S. C. EDWARDS has tendered his resignation as assistant superintendent of the Ft. Wayne & Wabash Valley Traction Co. Mr. Edwards has been in the employ of this company for a number of years and is a well-known traction man.

MR. CHARLES R. VAN ETTEN, general freight agent for the Brooklyn Rapid Transit Co., has resigned his position and Mr James B. McQueeney has been appointed acting general freight agent. This change was effective April 1st.

MR. A. W. ANDERSON, who has been general superintendent of the Dayton & Xenia Transit Co., has resigned and has been succeeded by Mr. T. A. Ferneding, formerly the assistant superintendent. Mr. Anderson has not yet announced his future plans.

MR. B. A. CONNOLLY, who, for the past four years, has acted as auditor of the Schoepf traction interests at Lima, O., has resigned to accept a position with a large trolley system at Buffalo, N. Y. He was recently tendered a farewell banquet by his Lima friends among whom he is very popular.

MR. H. S. MILLER who, for the past year, has been acting assistant superintendent of the Walkill Transit Co., Middletown, N. Y., has recently been made superintendent. Prior to his connection with the Walkill Transit Co., Mr. Miller was dispatcher on the Atlantic City & Suburban Traction Co's. lines at Atlantic City, N. J.

MR. T. M. ELLIS has been appointed general manager of the Rockford, Beloit & Janesville Railroad Co. The management of the road has been turned over to the Farson interests but the transfer of the properties will not occur until later. Mr. Ellis is one of the well known electric railway men in the north central states.

MR. RICHARD BRECKENRIDGE has been appointed passenger agent of the Aurora, Elgin & Chicago Railroad Co. to succeed Mr. L. F. Reinhard, resigned. Mr. Breckenridge has recently been connected with the passenger department of the Chicago & Alton R. R. and prior to that time was connected with the passenger department of the Chicago, Burlington & Quincy R. R.

MR. E. C. FABER, formerly general manager of the Aurora, Elgin & Chicago Railway Co., has been made general manager for the entire system now controlled by the Aurora, Elgin & Chicago Railroad Co., which was recently formed by the merger of several Illinois traction properties as mentioned elsewhere in this issue. Mr. Joseph O'Hara has been made superintendent of transportation for the entire system.

Obituaries.

MR. GEORGE C. COOK, late of the firm of Adam Cook's Sons, New York City, died suddenly on March 21st. Mr. Cook was well known for his energy and business ability and held a high rank among the merchants and manufacturers of New York City. His loss will be keenly felt by a large number of friends in both the social and business world.

MR. J. L. BREEN, recently general manager of the People's Railway Co., of Dayton, O., was killed on March 29th while riding on one of his own cars. As the car was crossing a temporary bridge over the Miami River, Mr. Breen leaned out to look forward, was struck on the head by a post and knocked into the river. Mr. Breen came to Dayton from Chicago and was a street railway man of considerable ability.

MR. GEORGE O. WHEATCROFT, recently assistant secretary-treasurer of The Milwaukee Electric Railway & Light Co., died at his home in Milwaukee on March 21st. He had been ill but four days, his death being caused by pneumonia. Mr. Wheatcroft was one of the oldest street railway men in Milwaukee. He had been in active service since 1868, serving in various capacities until 1880 when he was elected secretary-treasurer of the Milwaukee City Ry. He served in this capacity until the present company was organized when he was appointed to the position which he held at the time of his death.

MR. G. MARTIN BRILL, president of the J. G. Brill Co. of Philadelphia, died at his home in Merion on March 31st. Mr. Brill's death was due to apoplexy. Mr. Brill was born in Hesse Cassel, Germany, in 1846, and when about two years of age was brought to Philadelphia. In 1868 he joined his father, the late J. G. Brill, in organizing the firm of J. G. Brill & Son which has since become one of the largest car manufacturing plants in the world. A year before his father's death in 1888 the firm became incorporated as the J. G. Brill Co. and following that year, Mr. Brill became its president, retaining the position until his death. In addition to being president of the J. G. Brill Co., Mr. Brill was a director in the American Car Co., the G. C. Kuhlman Car Co. and the J. C. Stephenson Car Co. He was also vice-president of the Nova Scotia Development Co., president of the Halifax & Yarmouth Railway Co. and a director in the Merchants' National Bank of Philadelphia and the Interstate Railway Co.

G. MARTIN BRILL

The Ubiquitous Picture Post-Card.

In line with the rapidly increasing use of the ever-present picture post-card as a medium of advertising, the West Penn Railways Co. has recently issued a very attractive series of these cards.

Considerable care has been taken in getting out these cards and they bear pleasing views of the picturesque scenery along the company's lines, interior and exterior views of the power house, illustration of the rolling-stock and the well-known West Penn trade mark.

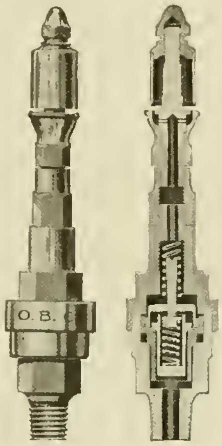
A New Pressure Annunciator.

Those familiar with the operation of air compressor governors are aware that these fail in their operation at various times. The chief element of danger in this failure to operate the air mechanism arises from the fact that it is possible for the operator not to notice that his pressure has dropped below the safety operating point, notwithstanding that this condition would be indicated by the registering gage.

The great advantages to be derived from the use of a device which cannot fail to warn the operator whenever the air pressure falls below or exceeds certain predetermined low or high air pressures, will be readily appreciated by users of air-controlled apparatus.

The Aikman pressure annunciator, manufactured and sold by the Ohio Brass Co., Mansfield, O., is designed to safeguard the operator against such conditions. This device can be adjusted to the exact low or high air pressures desired, and it has three distinct functions or uses.

First. When the air pressure drops below the low-pressure point previously determined (which point should be the low pressure at which the mechanism will always operate) the annunciator, which is generally installed on the storage pipe line leading to the engineer's brake valve, blows a continuous whistle for 15 seconds.



THE AIKMAN PRESSURE ANNUNCIATOR

Second. When the air pressure exceeds the high-pressure point previously determined, the whistle sounds continuously until the excessive air pressure is reduced to the normal high-pressure point.

Third. The annunciator also operates as a pop or relief valve, and will discharge to the atmosphere the capacity of the compressor, should the compressor become short-circuited, or the operator unable to stop it, thus preventing the burning out of electrical apparatus, or the blowing up of pipe lines or reservoir.

The device is compact in form, symmetrical in design, and there is practically no wear on the moving parts, as it has but one-sixteenth of an inch movement in its valve motion. When once adjusted to the desired high and low-pressure points, it always remains set. It is nine inches in height over all, and two inches in diameter. It will insure an even braking pressure at all times, and can be used upon any air-brake system in operation at the present time. The first cost is small, there is no maintenance expense, and it can be installed quickly and easily.

An illustrated pamphlet, descriptive of this annunciator, has just been issued and will be mailed upon request.

A Good Attraction for Amusement Parks.

In view of the approaching park season, the "Street Railway Review" has, during the past two months, been devoting considerable space to the descriptions of suitable attractions for street railway parks. In addition to those already mentioned, attention is called to the high-diving horses, known as "Queen and King," which are owned by J. W. Gorman, 100 Boylston St., Boston, Mass.

Mr. Gorman, who is one of the pioneers in the furnishing of park attractions, states that the extraordinary high dives which his horses make are attracting attention from all parts of the world. The horses, of their own accord, walk up a gangway and take a position on a permanently fixed platform. Then placing their feet on a shelf just below their heads they jump into space striking the water below very much in the same attitude that a human being does. After the dive they swim to the landing place and climb out without assistance. The dive is made with lowered head and legs outstretched in a graceful manner. The fact that the horses dive for the "fun of it" adds to the attractiveness of the act as an amusement feature for parks of the better class. Mr. Gorman is now booking his horses for engagements during the summer months.

Underwood Springs Park, Falmouth, Me., owned by the Portland Railroad Co., is to be reopened this season, after being closed for several years.

New Publications.

REINFORCED CONCRETE by F. D. Warren; 271 pages; bound in cloth; price $2.50 net; published by D. Van Nostrand Co., 23 Murray and 27 Warren Sts., New York City. This publication is intended as a reference hand book and is especially adapted to the needs of architects, engineers and contractors. It treats of a general form of design rather than of any one particular or patented system, the form treated being one to which any particular system may be applied.

The book is divided into four parts. Part 1 gives a general but concise resumé of the subject from a practical standpoint bringing out some of the difficulties met with in practice and suggesting remedies. Under Part 2 is compiled a series of tests justifying the use of various constants and coefficients in preparing the tables later presented, as well as bearing out the theory of elasticity. Part 3 contains a series of tables from which the designer may obtain all the necessary information to meet the more common cases in practice. Part 4 treats of the design of trussed roofs from a practical standpoint. Various types of trusses are treated and illustrations are given. There are also tables in which the sizes of the various members of the different spans are given and curve diagrams are also included showing the relation of the cost to the span. This book will make a valuable addition to the library of any practicing engineer.

STONE & WEBSTER have recently issued, for the year 1906, a publication containing considerable information concerning the various electric railway and lighting properties managed by them. The earnings and expenses of the various companies are tabulated for the 12 months ending Dec. 31, 1905. There follows a separate summary for each property in which is included the extent of the district in which it operates, information regarding its stocks and bonds, the amount of equivalent single track which it operates, the nature of its franchise, the population served and the date of its annual meeting. There is also given a complete map of the system. There are also included in the book, suggestions for the guidance of stockholders in transferring their stock. These suggestions are concise and comprehensive and will no doubt prove of much value. The book contains 61 pages and is bound in leather.

TRANSACTIONS OF THE INTERNATIONAL ELECTRICAL CONGRESS held at St. Louis in 1904. This publication consists of three volumes containing a total of 1,925 pages. It deals first with the organization of the congress. There follow the proceedings of the general meetings of the congress held in St. Louis on Sept. 12 and 17, 1904, and the proceedings of the Chamber of Delegates sent by the various governments to the congress. The transactions which follow include a number of carefully prepared and interesting papers on a variety of electrical subjects by men of prominence in the electrical field from all parts of the world. Among these an interesting paper on "The Electrification of Steam Railroads" is presented by Bion J. Arnold of Chicago and there is also a paper on "Alternating vs. Direct Current Traction" by Prof. Dr. F. Niethammer of Germany. There is also included a list of the members of the congress and a list of the subscribers to the transactions. The transactions were published under the care of Dr. A. E. Kennelly, general secretary, and W. D. Weaver, treasurer of the congress, to whom much credit is due.

POOR'S DIRECTORY OF RAILWAY OFFICIALS, February, 1906. Published by Poor's Railroad Manual Co., 68 William St., New York City, 244 pages. This publication is supplementary to Poor's Manual of Railroads and contains a list of the officials of all the railroads (steam, electric and other) in the United States, Canada and Mexico. Special lists of purchasing agents, master mechanics and chief engineers of all the roads are included. There is also included a general exhibit of statistics for the fiscal year, together with comparative statements of mileage, equipment, liabilities and assets, traffic operations, earnings, interest and dividend payments, etc., for steam roads for several years past.

REPORT OF THE SECOND ANNUAL CONVENTION of the Iowa Street & Interurban Railway Association. Compiled and distributed by L. D. Mathes, secretary, Dubuque, Ia. Bound in cloth, 67 pages. This publication is a complete account of the proceedings of the second annual convention of the Iowa Street & Interurban Railway Association held at Dubuque, Ia., April 20th and 21st, 1905. It includes the minutes of the meeting, the presi-

dents' address, the reports of the various officers and committees and the papers which were read before the meeting.

ELECTRIC RAILWAY ACCOUNTING, by W. B. Brockway, general auditor Nashville Railway & Light Co., Nashville, Tenn. Published by the McGraw Publishing Co., 114 Liberty St., New York City, 84 pages, bound in cloth, price $1 25 net. In this new book electric railway accounting is described and illustrated in a very thorough yet simple manner. The monthly report, the accounting department and the accountant are taken up in turn and a number of forms of reports are reproduced. The book contains interesting discussions of what a report should be, the relation of operating expenses to earnings, the value of curves as a means of expression, what standardization of accounts means and notes on expert examinations.

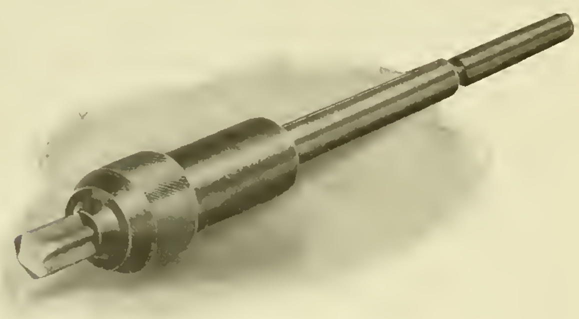
THE BUSINESS OF CONTRACTING, by Ernest McCullough, member of the Western Society of Civil Engineers. Published by the Technical Book Agency, Chicago, Ill., 45 pages, bound in paper, price 50 cents postpaid. This publication contains a number of articles reprinted from "The Contractor." Its object is to help those engaged in the business of contracting. The contents of this book will be found of considerable value to builders and contractors.

PRACTICAL ELECTRIC RAILWAY HAND BOOK, by Albert B. Herrick, consulting electric railway engineer. Published by the McGraw Publishing Co., 114 Liberty St., New York City, second edition, revised and corrected, 450 pages, bound in leather, price $3.00 net. In this second edition, a number of sections have been rewritten and expanded and new subjects have been introduced to accord with recent developments in the electric transportation industry. New methods of testing have also been described and data on new types of apparatus have been added. It has been the author's effort to develop this hand book along the lines originally proposed and to keep within the limits of what is accepted as conservative engineering. He has also restricted the use of formulas and mathematics as far as possible, so as to make the text useful to the greatest number of co-laborers in this field.

A High-Speed Tool Steel Bit.

It has been said that the introduction of air hardened, or what is known as high-speed tool steel, has, in the past few years, made a considerable change in machine shop methods, by trebling the cutting speeds and more than doubling the output. This steel has never before been successfully used for drilling purposes as the high price of the material required the design of a simple bit, inexpensive to make, in order to get the bit down to an attractive cost figure.

The bit shown in the illustration is known as the Rich flat bit and, for track drilling purposes, is being furnished exclusively by the Buda Foundry & Manufacturing Co., Chicago, Ill., for use in the



THE BUDA TOOL STEEL BIT.

Paulus, Buda, Wilson and other drilling machines. It is claimed for these bits that they hold their cutting edges from 10 to 15 times longer than twist bits. Many tests have shown them to exceed even this. At West Albany, N. Y., a single Rich bit drilled 100 holes in ordinary steel rail and was so little dulled that it was thought capable of completing another 100 holes. The test was not continued because the officers were then satisfied, stating that their average had been only about 10 holes with twist drills. On another road in a later test, a single bit drilled over 200 holes without regrinding. In these tests the Paulus drilling machine was used.

A special spindle and chuck is required for the Rich bit, but as it is interchangeable with the earlier style, any drill made by the Buda company may be equipped with it, the change being a simple one to make. Another feature of advantage is shown in the design of the chuck which permits the bit to recede into it until only enough of the steel is presented to penetrate the work. As the point is worn away an adjustable thrust block inside the chuck allows the bit to be brought forward until it is used up to within two inches of the butt. A great saving in the steel is here effected. With double the usable steel in the bit and requiring to be reground only one-tenth to one-fifteenth as often as twist bits, the economy is apparent. The Buda company has recently issued a booklet which exhaustively goes into the matter of their drilling devices and the Rich bit and spindle in particular.

(Mr. Turner's address, continued from page 193.)

release when we control the automatic exhaust from the triple valve by means of the brake valve, as is done in this case. The equipment consists of a small plain triple valve, an automatic brake valve and the usual main reservoir, compressor and governor with feed valve in addition, which reduces the main reservoir pressure from the main reservoir to the brake valve and into the brake pipe. It is applied in the same way as we apply the ordinary quick-action automatic brake. This brake also possesses the quick re-charge feature which is so necessary in traction service.

The heavy fast Boston tunnel cars are intended to be run in two or three car trains from the city of Boston through the tunnel under the bay to East Boston. These cars are equipped with the AMT schedule, which includes an interesting departure. The equipments that have been described are intended for light surface traction service and not for interurban or heavy traction work. The AMT is scheduled for heavy traction work.

The AMT possesses all the features of the combined automatic and straight-air brake and having only one brake valve. The safety features of this equipment, which include the features of straight air, are far in excess of the old automatic brake, because the auxiliary reservoir can be re-charged in about seven seconds, completely re-charging it from 50 to 70 lbs., so there is no danger of a man losing his brake for want of air unless he uses his air faster than the compressor can supply it. The AMP equipment is suitable for motor and trailer or for any number of motors coupled together, or motors and trailers mixed in trains up to five cars no matter how the train is made up. This consists of practically the same number of parts as the AMP with the triple valve placed on a bracket or on the cylinder head as may be desired.

The trains on the Long Island suburban extension are equipped with the AMR schedule, as are those on the New York and Chicago elevated roads. The operation is identical with that of the AMT with the addition of quick action, because the trains may consist of as many as eight cars. This schedule has greater safety than the old automatic and all the flexibility of the straight air, with the defects of neither one. The difference in the schedules consists in the AMR triple valve having another section which extends below the slide-valve chamber and contains the quick-action feature.

This leads to the final development up to date of the automatic brake which consists of the addition of electrical features. This brake as applied in this case consists of exactly the same equipment as the AMR with the electric features added. Electrical contacts are added to the brake valve and two magnet valves located next to the triple valve. With this equipment it is possible to apply and release the brakes without any brake pipe reduction whatever. There is no waste of air aside from what comes out of the exhaust port when the brake is being released. The brake can be applied and released in the usual manner. The two magnet valves and the brake valve can be added to the earlier types of equipment, thus making an electro-pneumatic brake. The automatic operation of the brake is precisely the same as though the electric control was not attached.

The means for operating the brake electrically simply consist in having three contacts on that brake valve, one to supply current, one which energizes the release magnet and another which energizes the application magnet of the equipment if the motor-

man wants to apply the brake. This magnet simply closes the exhaust port of the triple valve when it is energized. If the motorman moves the brake valve handle over to the application position, the application magnet is then energized and opens a valve and the air flows from the auxiliary reservoir through the magnet valve down into the exhaust cavity of the slide valve of the triple valve, and through the service port, then to the cylinder applying the brake. This brings about the finest kind of service application. Applications are had by making and breaking the contact; a pressure of one pound or a fraction of a pound are available at any time, or full cylinder pressure with one application if it is desired. In the electric lap position the application magnet contacts are open and the release magnet contacts closed. When it is desired to release the brake the handle is simply moved to the release position. This de-energizes the release magnet and it immediately lifts from its seat and lets the air from the brake cylinder out through a pipe to the atmosphere. If it is desired to complete the release, the handle is allowed to remain in this position. If only a partial or gradual release is desired, the handle is moved back to the electric lap position. The magnet is then energized; it comes down and closes the exhaust port so that the brake cylinder exhaust is cut off. It is next moved back to release position, and, of course, we get another exhaust from the brake cylinder which can be cut off in the same way. So it is seen that this equipment performs all the functions of the straight air with a degree of refinement that is not possible with straight air, to say nothing of the automatic, and, moreover, the auxiliary reservoir is re-charged while the brake is applied. In the first place, the reversion is only very slightly depleted, never more than five pounds is taken out, and it is feeding in all the time air is being taken out; consequently the auxiliary reservoir is constantly and fully re-charged for use should an emergency arise. This brake not only possesses extreme safety and flexibility, but also economy, as the only air that is vented to the atmosphere is that which comes from the brake cylinder when the brake is released, and it is only in emergency applications that any brake pipe reduction is required. The AMR and AMT schedules possess all these features with the exception of that last mentioned.

This brake is not affected in its operation by the length of the train; that is, the service applications and releases of the brakes are not obtained by a reduction or increase of brake pipe pressure; but the means of governing the flow of air to and from brake cylinders are located on each car. These, in turn, are operated by contacts under the control of the motorman or engineer, so that the power operating the valves (electric current) is entirely independent of and different from that which does the braking. This feature permits of the application and release of the brakes being instantaneous and simultaneous on all the cars in the train. This is not only obtained for full applications and complete releases, but whenever it is desired to graduate them on and off in steps. Perhaps more important than this, the auxiliary reservoirs are constantly charged so that any braking power up to the maximum can be obtained at any time, and in an emergency quick action can be obtained by moving the brake valve handle to the regular emergency position. From the foregoing it will be seen that we have a brake that will meet any and all conditions that may demand its adoption either in special conditions or general.

I believe that the absolutely necessary qualities of a brake for traction service are, safety, flexibility, simplicity, fool-proof and interchangeability. In order to have safety, two things are necessary. The highest possible braking power and means for obtaining that braking power at any time, no matter how foolish or thoughtless the motorman or operator might be in wasting his air. Any brake that possesses safety features to a maximum must necessarily be automatic; that is, it must have the feature that if anything happens in any way to the pipes under the car, the train will be stopped.

In making a stop, we desire accuracy, smoothness and the question of time. Now the shortest possible stop that can be made is to apply the brake in full and allow the train to come to a standstill. This would sacrifice accuracy and smoothness. The smoothest stop that could be made would be to shut off the power and drift to a standstill. This would sacrifice a great amount of time. Neither of these methods could be used in practical operation. To obtain the three desired points, there must be a means of

applying the brake severally, putting as much pressure in the cylinder as the speed will warrant, and gradually let the pressure out of the brake cylinder, thus feeling the way to the proper point or place to stop. The brake that has the ability to do all these things is certainly a flexible brake. These features are possessed to a maximum degree by straight air on a single car.

The next thing that is desired is simplicity. Straight air also has this feature to a very marked degree, so far as the operation is concerned. It also possesses another feature, and that is that a man can waste his air until he has very little to stop with unless he is careful. The degree of simplicity possessed by the straight-air brake perhaps will never obtain with a purely automatic brake, because certain complications come into the operation of an automatic brake that is not the case with straight air, as for instance a number of cars coupled together. But the fact that we have complications is not necessarily detrimental. It is a question of results. When we discarded the straight-air brake for the automatic, it meant safety. This is, of course, of prime importance and no manager here today would think of running an equipment that would not have the factor of safety developed to the highest possible point. In this recent development of air-brakes we have increased the simplicity of the automatic brake infinitely as compared with what was required in the way of the old automatic equipment. With it the requirements are about the same as with straight air. The features of quick service, graduated release and quick re-charge, reduce it to a far simpler brake than the standard automatic, and give the flexibility of the straight air without the undesirable features of either the old automatic or the straight air.

Now, there is what is called "fool-proof" or reducing the human element to the lowest possible factor. It is possible for a man with either straight or automatic air to so use up his supply that the braking power may be seriously reduced. With the AMT or any similar equipment the human element is reduced to a minimum, because it is impossible for him to reduce his braking power by "fanning" the brake, as it is called; so that he has got his maximum braking power at all times.

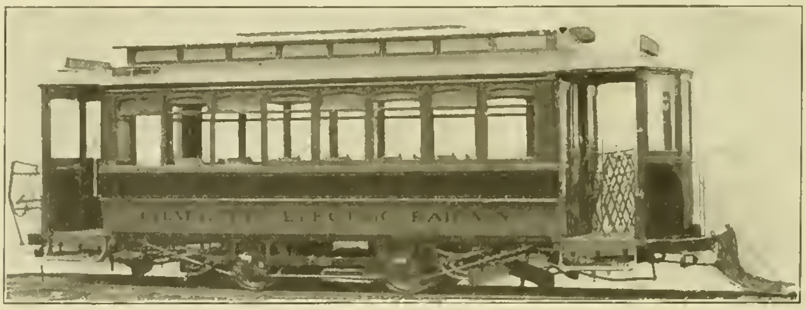
Most of the equipments that I have mentioned can only be used on trains that are equipped with the same kind of equipment. The AMT can be applied to any train consisting of from one to five cars, and possesses all the good features of the other brakes that I have mentioned and with this valuable addition, that it can be coupled up into trains of five cars. This is a very valuable feature where joint track features exist, and this should be given as much attention as the motive power. It also means a very much less knowledge required on the part of the motorman on account of the apparatus being general; it means, of course, less stock carried for repairs, and it means a uniformity of operation which, to get the best results, is indispensable.

In concluding his very interesting history of air-brake development, Mr. Turner showed his audience, by means of charts thrown upon a screen, several sets of curves made from the results of various braking tests. In describing these curves the speaker brought out the desirable features of the later types of products and forcibly illustrated his earlier idea that a large amount of money is now being spent to increase the powers of acceleration, which money, if applied to the problem of perfecting deceleration, would be more effectively invested.

Brill Car for Charlotte, North Carolina.

The Charlotte Electric Railway, Light & Power Co., of Charlotte, N. C., has added to its equipment one new closed car constructed by the J. G. Brill Co. of Philadelphia. The road over which this car is to operate is 16.5 miles long, 26 cars constituting the rolling stock. The line extends to Latta Park which is controlled by the railway company. Charlotte is a flourishing city of 18,000 inhabitants, and is second only to Raleigh, the capital of the state, as an industrial and manufacturing city, its chief manufactures being cotton, tobacco and lumber, the growth of the latter industry being very remarkable throughout the state in the past few years. The new car that has just been acquired by the railway company is of the closed type, the upper sash being stationary and the lower arranged to drop; it is mounted on one Brill 21-E truck with 7-ft. wheel base and 33-in. wheels. Four similar cars were shipped to this same company some time ago.

The following figures will show the dimensions of the car: length over end panels 20 ft. 8 in.; length over crown pieces and vestibules, 30 ft. 1 in.; width over sills including plates, 7 ft. 4 in.;

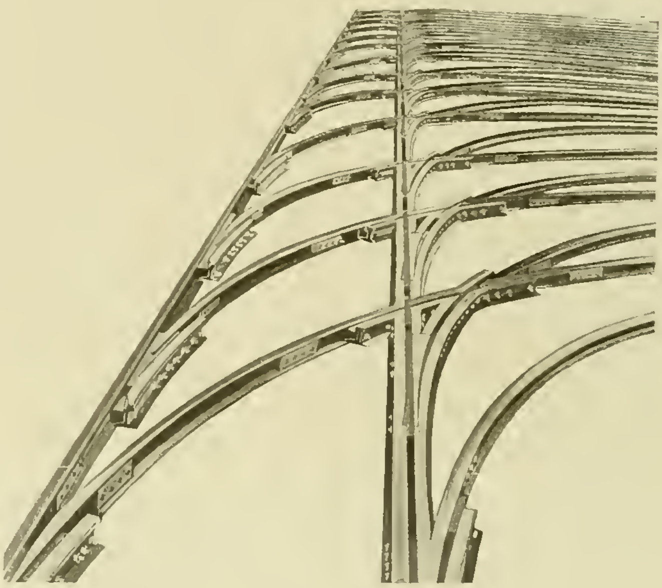


BRILL CAR FOR CHARLOTTE, N. C.

width over posts at belt, 8 ft. 2 in.; sweep of posts, 5 in.; centers of posts, 2 ft. 5 in.; size of side sills, 3½ x 5⅜ in.; size of end sills, 3½ x 6⅞ in.; thickness of corner posts, 3⅝ in.; thickness of side posts, 1¾ in. The inside finish of the car is natural cherry with bronze trimmings; ceiling of decorated birch; Brill seats of spring cane; corner grab handles, and track scrapers at each end of the car.

An Interesting Special Work Layout.

The accompanying illustration presents a view of a car barn layout of the tongue-switch type manufactured by the Indianapolis Switch & Frog Co., Springfield, O. This type of special work is known as "built-up" construction. All parts are made of steel T-rail which are securely bolted together and filled in, forming a particularly rigid type of construction, adapted for use in



A CAR BARN LAYOUT OF BUILT-UP CONSTRUCTION.

exposed work about car barns and in terminal yards. This "built-up" work is also used for passing switches and turnouts.

The tongue switches are constructed in a very durable manner, being guarded with a full section of rail which is also extended for a distance of eight feet beyond the switch point. This gives a strongly guarded tongue switch which is without extra joints. The mates are constructed with a solid steel floor and are made extra heavy throughout. The switch tongues are manufactured of a high grade of hammered open-hearth steel and when used in connection with passing switches or turnouts, are provided with an automatic throwing device.

STREET RAILWAY REVIEW

Vol. XVI MAY 15, 1906 No. 5

The Conestoga Traction Co., Lancaster, Pa.

Being a Description of the Methods of Operation, Fare Collection, Recent Improvements and Extensions.

Operation by the Limit System.

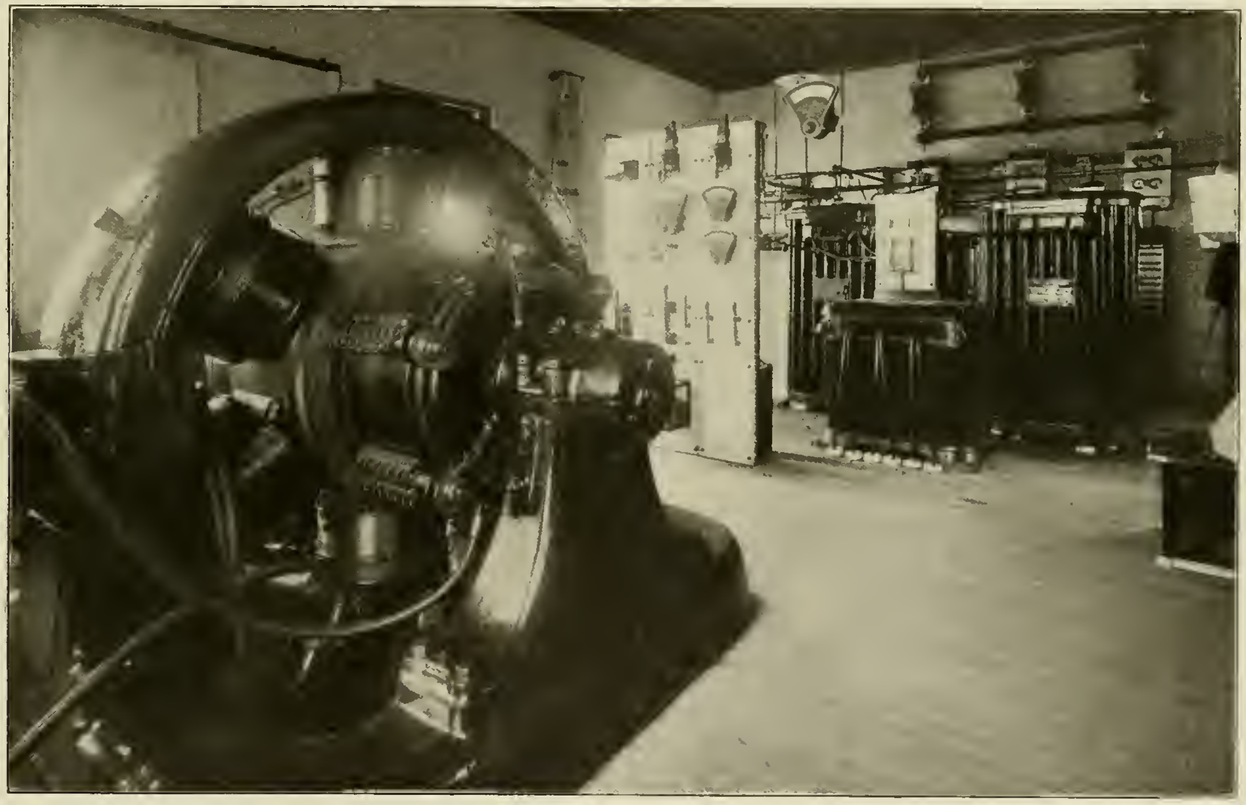
BY C. E. TITZEL, SUPERINTENDENT.

The method of car operation as practiced on the lines of the Conestoga Traction Co., Lancaster, Pa., is quite unique and interesting. This system has 147 miles of road over which there are regularly operated, from 40 to 50 cars. The arrangement of the routes is such that some of the various lines make joint use of portions of single track of some length. The successful results occasioned by the use of the method of operation, which will be described, have shown that no train dispatching or block signaling is necessary.

The company has devised a schedule for the operation of each car and these schedules have been published in a book form so that they are readily handled by trainmen. A schedule for the operation of any one car shows the exact time this car should arrive at and depart from the various turnouts. The rules of the company make it compulsory that the car keep on time or within the first "limit." If this is found impossible, this car must drop back to the second limit, thus throwing its meeting point at a turnout other than the one regularly used.

As an important part of this system of operation, turnouts have been placed at intervals of four or five minutes' run, over the entire trackage of the company. The spring switches used on the system are left open on the main line at regular meeting points and closed at all other turnouts.

All cars start from Center Sq., Lancaster, on schedule time and are required to reach each turnout on the line and the end of the run at various set times. In order that the entire schedule may not be interfered with should that car be unavoidably delayed, a system of "limits" has been provided. A train running on time proceeds according to the schedule, until a meeting point is reached. If the car which is to be met at this point is not in sight the first car waits five minutes, the first limit, and then if the car has not appeared, proceeds. Should the car running in the opposite direction be more than five minutes late because of unavoidable delays, and the trainmen find that they cannot reach the regular meeting point inside of the first limit, the train waits at the next turnout, which is not a regular meeting point, until the second limit and then proceeds as before. The second limit in most cases, is 15 minutes later than the regular schedule. If a car is delayed so that it gets behind the second limit, then it is necessary to drop back and take up the schedule one-half hour late.



INTERIOR OF SALUNGA SUB-STATION SHOWING CONVERTER AND SWITCHBOARD. CONESTOGA TRACTION CO.

The accompanying schedule for the operation of the Lancaster & Adamstown Division very clearly shows the plan herewith described. There is a turnout at each of the stations given. When running on

half-hour headway, the regular meeting points as indicated thus, (*) are at Minnick's, Mechanicsburg, Metzler's, Ephrata and Lesher's. Cars leave both terminals on the even hour and half-hour and one and one-half hours are required to make the entire run. To further illustrate the limit system, it will be noted that cars leaving Lancaster and Adamstown on the half-hour, if on time, will meet at Minnick's on the three-quarter hour. If, for any reason, the west-bound car cannot arrive at Minnick's within five minutes after it is scheduled as due, which is the first limit, it lays over at Eden until the second limit. During this layover, the east-bound car, if

CONESTOGA TRACTION CO'S. STANDARD RAILWAY SUB-STATION.

on time, will pass at this point on the first limit. If a car is disabled between stations, flagmen are sent out to protect it.

Each trainman is furnished a book which contains the running schedules of all the suburban lines. Before the motorman or conductor is allowed to take charge of a car, he must familiarize himself with the contents of and thoroughly understand the meaning of all the schedules and rules in this book. The details of operation are so thoroughly tabulated in this book that no matter what emergency arises, a reference to the book will instruct the employe just what action should be taken. The rules set forth in the book are iron-clad and no official has the right to order any changes therefrom. After having started from Lancaster, the operation of the cars is left entirely in the hands of the trainmen until the round trip over the entire division is completed.

While the schedules operated on the suburban lines of the Conestoga Traction Co., have in no case a headway of less than 30 minutes, the limit system has been satisfactorily operated with a 15-minute schedule. Where two divisions unite and the cars of each operate over a single line, under a 15-minute schedule, it has been found practicable to couple the cars at such junction points and run them as two-car trains over the common track. This greatly simplifies their operation.

The operation of cars on close schedule time at all stops along the line, increases travel to a marked degree. During the past two years, a large proportion of the Conestoga Traction Co's. increased earnings is directly accountable to time-schedule operation of cars.

A dispatcher is employed by the company, but he has no authority over the operation of a car after he has given it starting orders. His duties are to see that all cars leave the terminal on schedule time and he is also required to superintend the trainmen.

Lancaster, Mechanicsburg, Ephrata, Reamstown and Adamstown Schedule.—Eastward.

	Time. A. M.	First Limit. A. M.	Second Limit. A. M.	Time. A.M.	First Limit. A. M.	Second Limit. A. M.
Lancaster (leave)	4:30	4:35	4:43	5:00	5:05	5:13
Lime and Walnut	4:35	4:40	4:48	5:05	5:10	5:18
Park Turnout	4:38	4:43	4:51	5:08	5:13	5:21
McGrann's Station	4:40	4:45	4:53	5:10	5:15	5:23
*Minnick's	4:45	4:50	4:56	5:15	5:20	5:26
Eden	4:47	4:52	4:58	5:17	5:22	5:28
Binkley's	4:50	4:55	5:01	5:20	5:25	5:31
Zook's	4:53	4:58	5:04	5:23	5:28	5:34
Bard's	4:57	5:02	5:08	5:27	5:32	5:38
*Mechanicsburg	5:00	5:05	5:15	5:30	5:35	5:45
Rotary	5:05	5:10	5:20	5:35	5:40	5:50
Bender's	5:07	5:12	5:22	5:37	5:42	5:52
Brownstown	5:11	5:16	5:26	5:41	5:46	5:56
*Metzler's	5:15	5:20	5:30	5:45	5:50	6:00
Akron	5:20	5:25	5:35	5:50	5:55	6:05
Steinmetz's	5:25	5:30	5:40	5:55	6:00	6:10
*Ephrata	5:30	5:35	5:45	6:00	6:05	6:15
Mohler's	5:36	5:41	5:51	6:06	6:11	6:21
Landis's	5:41	5:46	5:56	6:11	6:16	6:26
*Lesher's	5:45	5:50	6:00	6:15	6:20	6:30
Reamstown	5:47	5:52	6:02	6:17	6:22	6:32
Mechanics Corner	5:50	5:55	6:05	6:20	6:25	6:35
Lauch's	5:52	5:57	6:07	6:22	6:27	6:37
Muddy Creek	5:55	6:00	6:10	6:25	6:30	6:40
Regar	5:58	6:03	6:13	6:28	6:33	6:43
Adamstown (arrive)	6:00	6:05	6:15	6:30	6:35	6:45

* Regular passing points.

Three-car schedule on a 5-minute limit; six-car schedule on a 5-minute limit when cars are running between Lancaster and Adamstown.

Four-car schedule on a 5-minute limit when cars are running between Lancaster and Ephrata.

[Editorial Note.] In order that he might witness a practical test of the limit system of schedule operation as has been described by Mr. Titzel, a representative of the "Street Railway Review" recently accepted an invitation to make a trip over the lines in a special car and observe the practical working of the system of operation. The special car left Lancaster between schedules, at 9:10 a. m., and ran unannounced, over the Lancaster & Adamstown and the Lancaster & Terre Hill divisions without confliction. So thoroughly did the system operate that the regular cars were passed at the various turnouts, not regular meeting points, with less than a minute's delay at any point. To give the system a more severe test, the special car, on request, was reversed in direction and run against the outgoing schedule. Thus for three hours this interesting method of operation was tested on the divisions where the most frequent headway is maintained. The special car met and passed the regular cars on turn-outs in the same manner as regular cars meet and pass. Not once during the several hours' run, was there the slightest possibility of an accidental meeting with the regulars on any of the lines traversed. It may here be noted that this company's lines are all on single-track construction.

General Operation Methods.

The system of the Conestoga Traction Co. is divided into "eastern" and "western" divisions. Trainmen are required to learn the city lines and one division. When a new man is employed he is taught on the city lines for two weeks after which, if he is capable, he is placed in charge of a car. After working on the city lines for

RAILWAY AND LIGHTING STATION AT COLUMBIA.

two months he is sent out on the suburban lines. On account of the schedule system of operation used, the suburban runs are considered more intricate than the city runs and are not trusted to inexperienced men. The management is very careful not to place two men on opposing runs and thus increase the chance for accident through disobedience of the rules described earlier in this article. Much care is taken in the selection of men for the head end of cars and as a result the company has obtained a very competent set of motormen. Rigid rules are in force and if any employe overlooks the schedule he is summarily dismissed.

All cars, city and interurban, arrive at and depart from the public square in Lancaster which is located at the center of the city.

With two exceptions the city cars operate on belt lines and suburban cars reach the square over the incoming tracks. By this arrangement there are very few accidents within the city limits.

About 85 per cent of the money for passenger fares on the entire system is received through the ticket windows. Single fare, round trip and coupon tickets are sold on the city and interurban lines. Round trip tickets are sold at about one and a half cents per mile, or one-half a cent per mile less than the cash fare. Coupon books containing 100 five-cent tickets are sold for $4.25. These coupons may be used, at their face value, in paying for tickets. In the borough of Columbia and in Marietta books of 50 tickets are sold for $1.50. These are small towns and the reduced fare aids in stimulating travel. Transfers are issued in the cities served on any form of ticket. Heretofore the company has tried to centralize its travel by arranging for all transfering at a central point, but is now establishing new transfer points with a view to distributing the travel.

No regular system of advertising has been inaugurated to induce extra travel. Neatly designed pamphlets containing the time tables of all lines are distributed from the stations. Cards bearing the regular rates of fare between points and other cards with special rates for the transportation of parties of 100 or more persons are issued upon demand. On special days dash-board signs are used on the cars. The company does not operate its own amusement resorts though it serves several parks in the county. To promote increased travel to these points when celebrations are scheduled special rates are made. Special cars are furnished to any point on the lines when 40 fares are guaranteed. No cars are furnished for less than $10, except in the city of Lancaster where a rate of $5 an hour is charged. A set rate of one round-trip fare multiplied by 40 is charged for funeral cars, except when this amounts to less than $10; in Lancaster $5 is charged. Rates for freight cars are ascertained by multiplying the round trip fare between the points where the freight is loaded and unloaded by 30.

Rural Fare Collections.

Because of the peculiar situation of Lancaster with reference to the towns and rural districts which the railway company's lines serve it was found necessary to establish comparatively uniform fare limits on all of the suburban lines. While working out a system the Conestoga Traction Co. had the same expensive experience that many other companies, using the overlapping system of collection, are having. After experimenting for a number of years in an endeavor to work out a uniform system whereby both the company and public interests could be protected, the superintendent of the company devised the overlapping chart system, a portion of which is reproduced herewith. Since this system was adopted as official the company has increased its receipts by a large amount that previously was uncollected. In addition to gaining increased receipts, every passenger is at all times charged the same fare between two given points. A copy of the fare chart is given each conductor. This practice has been found very satisfactory.

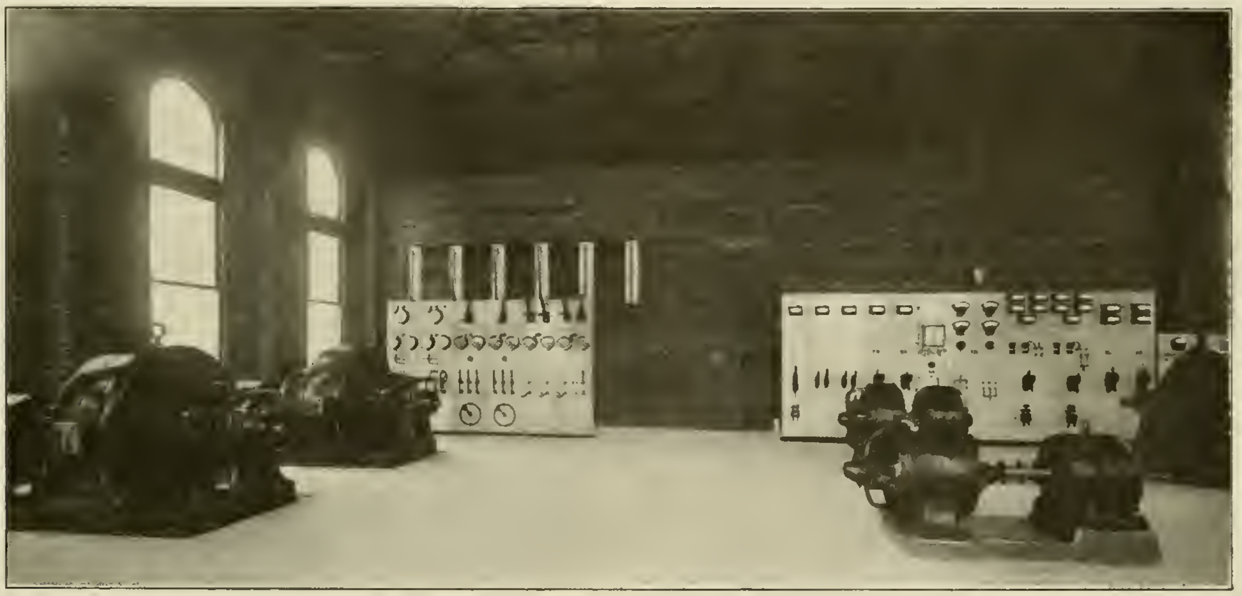
The total of the fare limits on any division is in each instance the regular one-fare rate between the terminals. With this as a basis for figuring, Lancaster, the central city, is taken as the starting point. As city travel is considered more expensive to handle than interurban the first limit is fixed at the minimum distance for a five-cent rate. A point near the corporate limits is chosen as the distance limit of the square on the chart. The remaining distance is divided into districts according to the travel and the importance of the points reached. The general scheme is to give long rides in the rural districts for the purpose of increasing travel.

On the 10 divisions operated separately by the company there were only two or three cases where the general scheme of fare limits could not be uniformly adhered to. On the Lancaster & Quarryville Division it was found that by the original plan of proportionment it would be necessary to either reduce the through, one-way rate or shorten the distance by one five-cent fare travel between the points served. On this division there is considerable travel between the stations known as Refton School and New Providence Road, which are 1.39 miles apart. According to the regular outline, patrons riding between these two points would be compelled to pay a ten-cent fare, which the company thought was not equitable. A special "overlapping limit" was arranged whereby the fare limit was made interchangeable. By this arrangement the usual five-cent fare is collected between the two points mentioned without interfering with the balance of the line. A similar situation was met with on the Terre Hill Division between Mechanics Church and Groffsdale Hotel. The chart, of which two divisions are reproduced herewith, also shows the length in miles of each fare limit and the total distance from the Lancaster terminal. A blue print copy of the chart for the entire system is placed in the hands of each conductor and fares are collected accordingly.

Before this chart was adopted the limit points were very indefinite and many complaints were brought to the officials from passengers who thought that they had been overcharged. After carefully adopting the scheme as described, uniformity was established, complaints were stopped and an increased revenue was obtained.

Improvements and Extensions.

The Conestoga Traction Co. is making many improvements in its system. During the past few months new lines were opened between Lancaster and Mount Joy, and between Lancaster and Quarryville, the Lancaster & Adamstown Division was extended to Terre Hill, two new sub-stations were built and the capacity of the main power house increased by one-half. Within 30 days another line, the Lancaster & Eastern, which is 17 miles in length, will be ready for cars.



ROTARY ROOM IN THE COLUMBIA SUB-STATION CONESTOGA TRACTION CO.

The Mount Joy Division is now one of the best paying of the company's several lines. This line branches off the Lancaster & Columbia Division at Hambright's Farm, 3.41 miles from Lancaster, and runs over a private right of way for 9.5 miles and along the Pennsylvania Turnpike for 2 miles, passing through the most fertile part of the county and serving several villages.

Seventy-pound rail is used in the track construction. This is laid with the company's standard gage of 5 ft. 2½ in., on 8-ft. ties

MAP OF THE CONESTOGA TRACTION CO.'S LINES.

bedded in 10 in. of crushed stone. In many places where fills were necessary crushed stone has been used in the grading. The overhead work is of bracket and span wire construction. Throughout the system controlled by the Conestoga Traction Co. span wires strung on poles set eight feet from the track center have been used wherever possible.

In building the Mount Joy Division the grade was kept down as low as possible, but owing to the hilly country through which the line passes a maximum grade of five per cent was allowed. Four pony-truss bridges were built on the line the longest of which is located near Salunga where the track spans the Big Chickies River. The special construction feature of this line is a 3,000-ft. cut between Salunga and Benders which has a maximum depth of 20 ft., giving the line a three and one-half per cent grade at this point.

Power for the operation of the cars is distributed from a substation located at Salunga, which is 10.97 miles from Lancaster. A three-phase, high-tension line leads from the main power house at Engleside to this sub-station. Current is delivered to the transformers at a pressure of 10,000 volts. The sub-station building, which is illustrated, follows the design as adopted for other stations of the parent company. The high-voltage wires enter through the south walls and are led to the disconnecting switches, thence through the lightning arresters, oil circuit breakers and static transformers to a 600-volt rotary. General Electric machines are used here and in the sub-station at Martinsville on the Quarryville Division; all other stations on the Conestoga Traction Co's. lines have Westinghouse equipment.

The Lancaster & Quarryville Division is 8.2 miles in length. This line joins with the Lancaster & Strasburg Ry. six miles from Lancaster. From this point to Lancaster the cars of both divisions use a common track. The roadbed, track and overhead construction of this line do not differ from the type adopted for the other lines operated by the Conestoga Traction Co.

The Terre Hill extension of the Lancaster & New Holland Division, completed a few months ago, is 3.12 miles long. This line serves a very rugged territory and some very heavy construction work was necessitated. About 1,500 ft. of this line where it approaches Terre Hill is on a four and five per cent grade while at another point where the line crosses Conestoga Creek a seven-foot fill for a distance of 700 ft. was necessary. The line corresponds in construction details with the other lines operated by the company.

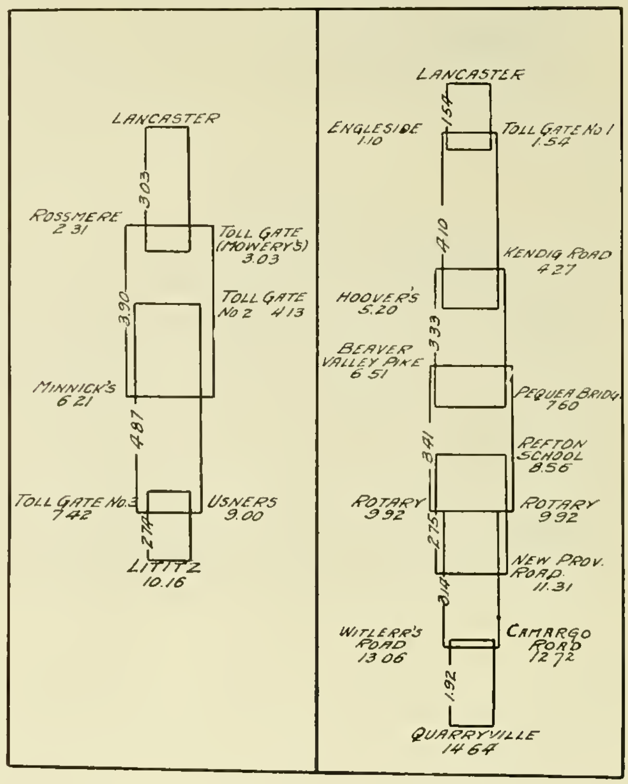
The Lancaster & Eastern Ry., which is to become an operation division of the Conestoga Traction Co. on June 1st, is one of the connecting links for a through line between Lancaster and Philadelphia. This road is being built from Lancaster to Christiana and will eventually be extended to the western terminus of the Philadelphia & Western Ry. which is now three miles from the eastern terminal of the Lancaster & Eastern Ry.

The route over which the new line is being constructed passes through the towns of Paradise, Lemn Place, Kinzers, Williamstown and Gap to Christiana, a distance of 17 miles. Outside of the terminal cities the line will serve a population of about 30,000.

The track and overhead work is of standard construction. A bridge over the Conestoga River just outside of Lancaster is the principal feature of the construction work. This bridge is 309 ft. long and consists of three pony truss spans of equal length. Steel girder spans of 75 ft. on the west and 125 ft. on the east sides form the approaches to the main spans. Four concrete piers, each 6.5x 20 ft. in section at the bottom and 4½ ft. wide at the top, have been built for its support. There are five other steel bridges and two stone arch cattle passes on the line. The track is laid on private right of way between Williamstown and Christiana. The remaining portion is on the public highways. When the line is completed the properties controlled by the Conestoga Traction Co. will parallel the main line of the Pennsylvania R. R. from Christiana to Mount Joy, a distance of 34 miles. Power for the operation of the Lancaster & Eastern line is to be supplied from a sub-station at Williamstown.

The Lancaster & Eastern Ry. is owned by residents along the line and is being built under the direction of the officers of the Conestoga Traction Co., who receive no salary for services. The road is bonded for the actual cost of construction and will be leased to the Conestoga Traction Co. for a term of 999 years on a six-per cent interest guarantee.

A new sub-station for railway and lighting purposes has been built at Columbia. This building is 51 x 65 ft. in inside floor measurement. It is divided into a rotary room 43 ft. wide, a transformer room 20 ft. wide and a lightning arrester and choke coil room 11 ft. wide. A large basement is provided under the rotary



PORTION OF SCHEDULE SHOWING FIVE-CENT FARE LIMITS.

and transformer rooms. Two three-phase high-tension lines, one for railway and the other for lighting purposes, pass into the building through porcelain tubes secured in 12 x 12-in. girders which are set in the brick walls just below the eaves. From the arresters

the wires pass directly to the rotary room where stick breakers, controlling the high voltage, are located. The switchboard is located near the south wall of the rotary room. There are two 200-kw. rotaries immediately in front of the switchboard. In the railway end of the transformer room six 75-kw. transformers are arranged in banks of three along the north and south walls. Direct current is carried from the building by No. 3 insulated cables, which feed the trolley wire at half-mile intervals.

The lighting equipment arranged in the western half of the building has a capacity of 400 kw. and furnishes current for power and lighting purposes in the borough of Columbia.

LIGHTNING ARRESTER ROOM IN THE COLUMBIA SUB-STATION.

The power house, located at Engleside, which furnishes power for the whole of the Conestoga Traction Co's. property and for the Lancaster County lighting properties, now has a generating capacity of 2,000 kw. and is being increased to 3,000 kw. to care for the new properties now being taken over. The installations which are being made include a Westinghouse 1,000-kw. generator, four Babcock & Wilcox boilers of 520 h.p. each, a Green fuel economizer, two Cochrane heaters, a 1,500-h.p. direct-connected engine and 12 transformers. A reinforced concrete stack 190 ft. high, with an 8-ft. inside diameter has been constructed.

Service Stripes for Street Railway Employes.

The officials of the Indianapolis, Columbus & Southern Traction Co. have raised the wages of their conductors and motormen and made arrangements to decorate them for services rendered the company.

The company has ordered a number of gold and silver stars and men with a record of five years' service will wear these stars, the motormen wearing the silver stars and the conductors the gold stars. Bands of silver and gold braid will also be attached to the sleeves of the uniform coats, gold bands for the conductors and silver bands for the motormen. A man who has been in the service for one year wears one band, and so on to five years. The record of the men in the company can thus be seen much the same as a soldier's position is recognized by the stripes and stars he wears.

The Gasoline Car for Interurban Service.*

BY F. W. HILD, CHIEF ENGINEER SOUTH-WESTERN WISCONSIN RY.

In view of the present widespread interest in steam railroad circles in the self power contained car as a means of meeting the increasingly severe competition of the electric roads, it may not be amiss to consider this type of car from the view-point of the electric railway engineer.

That the large roads have keenly felt this competition, has long been known and it is now particularly evidenced by the various methods under consideration for meeting it. The writer has seen experimental outfits utilizing the automobile principle of carrying the motive power on the truck frame. In one case, it was a high-pressure superheated steam engine with direct chain transmission and flash boiler, kerosene or gasoline pan burner, radiating condenser, etc., all very much the same as the equipment of the well-known "White" steam automobile. In another case it was a four-cylinder gasoline engine, with friction disc transmission, etc., similar to automobile equipment.

The independent motor car idea had its inception abroad and much more work has been done in this direction in France, Germany and Great Britain than in this country. The most conspicuous application of the idea is the steam motor cars of the Great Western Ry. of Great Britain. This railway has in use a number of modernized steam dummy cars using coal as fuel for steam generation. The preference on the continent seems to be for the internal combustion engine and several experimental gasoline engine cars are being tried.

The Wurtemburg Street Ry. is one of the most aggressive of foreign roads in trying the independent motor car. This railway has experimented with electric storage battery cars, with steam motor cars of the Serpollet type and gasoline cars of the Daimler motor type. It is interesting to note that the Wurtemburg Street Ry. put an independent gasoline motor car into service in December, 1893, something over 12 years ago.

There can be no doubt that most of the several types of self power contained cars will find useful fields of application and will become valuable auxiliaries to the standard forms of rail transportation; but also, in the judgment of the writer, there should be no doubt that these fields of application will be relatively restricted and do not include such as are now served by the standard electric system.

The factors which have made electric traction so brilliantly successful in city, urban and interurban service are many and varied, but those which enter into a discussion involving a consideration of other types of motor cars are reliability, simplicity, high schedule speeds, high train frequency, cleanly and noiseless operation, and low cost of operation and of maintenance.

On the other hand, the self-powered cars enjoy two advantages which are the sole reasons for the present interest in this type of car. They are the absence of external power transmission circuits and lesser initial investments. It is the purpose of this paper to briefly investigate and compare these several factors.

St. Joseph Valley Traction Car.

The equipment of the pioneer gasoline-electric locomotive built a year or so ago by F. M. Hicks & Co. for the St. Joseph Valley Traction Co. is fairly representative of its class. This car was described in the "Street Railway Review" for Apr. 15, 1905, page 263. The locomotive consists of a car body without vestibule, measuring about 35 ft. over bumpers and mounted upon two four-wheeled trucks. The power outfit includes a gasoline-electric direct-connected unit, a storage battery, a switchboard, a quadruple motor equipment and accessories consisting of a water cooling system, gasoline tank, and air-brake equipment.

*Read before the Iowa Street and Interurban Railway Association, Des Moines, April 19, 1906.

The entire space inside and under the car body is so completely taken up with the power equipment as to leave no room for passengers or merchandise, whence it follows that this car is a locomotive pure and simple, and is of use only with trailers. Its weight is approximately 37 tons.

All the apparatus in the equipment of this locomotive has demonstrated its utility in various fields of application, practically all of the electrical apparatus being standard for railway service, so it may well be said that there is nothing experimental about the outfit.

In view of the highly developed standard steam locomotive, it is extremely doubtful, unless the fuel cost of gasoline engines be enormously reduced, that such locomotives as just described will become popular. It is proper to say here that the St. Joseph Valley locomotive, which in itself is a very successful machine, is the outcome of exigencies arising from certain franchise restrictions affecting the motive power and time when the road had to be put in operation. The later equipment and the other self contained cars in construction or in operation, in all cases combine the motive power with the passenger or freight car, on the same set of trucks.

Apparently the greatest difficulty encountered by the designers of the gasoline cars, is the transmission of power from the engine to the driving wheel. This is not surprising, in view of the fact that the internal combustion engine is essentially a constant speed motor, and that railway work demands wide ranges of variable speeds. At the present time the favorite means appear to be the use of electricity, indicating that the difficulties of direct mechanical transmission and variable speed operation are so great as to warrant the rather round about transmission involved by the addition of generators, with or without batteries, and the standard railway type motors and control. Indeed, it is claimed by the promoters, that the efficiency of the gasoline-electric outfits compares very favorably with any type of mechanical transmission and moreover, has the greater advantages of large variations of speed, flexible driving, ease of control, and lesser wear and tear. The acceleration and change of speed are smooth, and without the jar or shock which is ever present with any mechanical change-speed gear. This situation suggests to electrical engineers the early discussions of the subject "Series vs. Shunt Motors for Railway Work." The designers of the gasoline-electric cars, while fully agreed as to the method of power application, nevertheless differ among themselves on the important question of power supply; thus some insist that a storage battery is an indispensable adjunct, for the reason that gasoline engines have low efficiencies at fractional loads and furthermore have practically no overload margin; the battery, therefore, is needed to take care of the recurring inevitable overloads. Others, however, prefer to use a much larger generating unit, largely because of the saving in weight and space, and the avoidance of acids and fumes.

The Union Pacific car is the best known of the straight gasoline cars and while not much of detail has been allowed to come to the public, the general features of the car are, according to the "American Engineer & Railway Journal":

Car body	56 ft. over all.
Weight	26 to 29 tons.
Seating capacity	approximately 50.
Motive power	100 h. p. (rated).
Gasoline engine.	

Gasoline Motor Car No. 2 of the Union Pacific Ry. is considerably larger than car No. 1 and has several improvements which were suggested by the tests made with car No. 1. It is 55 ft. long, has two 4-wheel trucks, and seats 57 passengers. It is of the same general design as car No. 1, is of steel construction throughout, and is said to be exceedingly strong for its weight. The car weighs 56,000 lb., although it is expected that additional cars which are to be built will not exceed 50,000 lbs., as it was very difficult to obtain proper material, and heavier parts were used than were necessary.

The car is driven by a 100-h. p., 6-cylinder gasoline engine, designed especially for this purpose. It has a "make and break" spark ignition, with a primary battery for starting and a magneto for regular running service. The lever which controls the metal clutch is operated by air, which is controlled by a specially designed operating valve, by means of which the car may be started at a slow speed and the engine disconnected or thrown into high speed at will. The driving wheels are 43 in. in diameter, the other wheels are 34 in., and all are of rolled steel.

The car is ventilated by means of Cottier suction ventilators. The circulating coils, for cooling the gasoline engine, are so arranged that during cold weather the fresh air supply for the passenger end of the car may be warmed by passing over them. The car is lighted by acetylene gas and the 25 panel lights are so arranged that while the lighting is very brilliant, it is of a mild and diffused character and not wearisome to the eye. The interior of the car is finished in antique mahogany with a cream white ceiling and decorated in gold and sepia.

The car has been in use since September 14th and is giving very satisfactory results. It accelerates rapidly and is capable of developing a high speed. It was built at the Omaha shops of the Union Pacific R. R., under the supervision of W. R. McKeen, Jr., superintendent of motive power, who has invented and patented the important features of construction.

General Comparison.

It probably needs no argument to show that the straight electric car considered alone, is far less complicated and hence far more reliable than any other form of motor car. The straight electric has the minimum of moving parts, all of which (excepting the brake mechanism, which is common to all cars) are non-reciprocating, while all other types of self-propelled cars have reciprocating mechanisms, which include a great number of moving parts, more or less complicated in adjustment. The greater simplicity and reliability of the standard electric car is perfectly obvious in the fact that, aside from the conductor or fare collector, but one attendant, the motorman, is necessary for the car operation, whereas, every type of independent railway motor car, so far as the writer knows, requires an additional skilled mechanic to look after the portable power plant. Of course efforts are and will be made to render the equipment so thoroughly automatic as to permit the dispensation of this skilled mechanic. But the question of reliability of the straight electric goes beyond the car itself and involves a consideration of power generation and transmission.

Power generating machinery, both steam and electric, has been brought to a very high order of development, and in the hands of thoroughly competent operators, the probability of interruption of power service through failure of this machinery is extremely remote particularly if the plant be provided with a judicious, yet reasonable reserve. There are plants in this country which have operated for years without failing to deliver power.

Early experiences served to give the power transmission system a reputation for weakness which was never fully deserved and which now no longer obtains. The heavy substantial construction of the modern transmission and overhead conductor systems enables them to withstand the ravages of storms very successfully. The greatest source of disturbance to power transmission is lightning. As a result of careful study, protective devices are now available which limit interruption to service to such a point that the transmission circuit given proper and reasonable attention is fully as reliable in every respect as any other part of the railway system.

Schedule Speeds and Train Frequency.

It is a peculiar fact that no other form of machinery, whether used for power generation, power translation, or power utilization, has such high efficiency, such capacity for overload and such flexibility of control as has electrical apparatus. The remarkable speed and torque characteristic of the series wound motor permit of a smooth and rapid rate of acceleration, absolutely under the control of the operator. This rate of acceleration may be practically anything desired, and is accomplished without resorting to excessive power demand or abnormally large motors. The maximum acceleration is usually determined by the comfort of the passengers, and by the slipping of the wheels, and is not limited by energy consumption. Indeed, it has been shown that for a given schedule the equipment having the highest rate of acceleration will perform the service with the least energy consumption.

The facility for maximum acceleration, the great capacity for overload, and the high ratio of power to weight, enable the straight electric car to handle successfully and economically higher schedule speeds than any other type of car, no matter how equipped. The steam engine operated car, because of the overload power of

the steam engine would probably come next, while the gasoline car, with direct mechanical transmission would, because of the absence of starting torque and of overload capacity of the gasoline engine, fall well below them all.

High accelerating power becomes more important as the number of stops in a given distance increases, and it is this fact, as well as the difficulty of mechanically transmitting power from the gasoline engine to the drivers, which renders combination gasoline-electric cars at present the most promising of the self contained cars.

The frequent train service of the standard electric system is made possible by the fact that practically no power is wasted. Experience of electric roads is such that the starting and stopping of the different train units so dovetail into one another that the load on the central power house is proportional to the energy consumption per train.

Any system of transportation using self contained motive power units must be obviously at a disadvantage in this respect, since fuel consumption must go on all the time the train is in service, whether it is coasting or standing at a station.

Cleanly and Noiseless Operation.

The great importance of cleanly and noiseless operation of trains is best evidenced by the action of the New York Central, New York, New Haven & Hartford, Pennsylvania, Long Island and the Baltimore & Ohio railroads in electrifying their largest terminals. It is well known that this action was largely brought about by public sentiment. That the builders of self contained cars appreciate the importance at least of cleanliness is indicated by the fact that nearly all are using oil for fuel, and practically none of them would consider the smoke, cinder and soot producing fuels such as coal, etc. The advantages, if any, are in favor of the standard electric system, for there must always be present some vibration and some exhaust fumes from the engine of the self powered car.

Operating and Maintenance Costs.

The absence of the actual operating data of self contained cars does not permit, at the present time, of a comparison of actual maintenance and operating charges between such cars and the straight electric. It is perfectly logical, however, to expect, in view of the complicated mechanism of the former and extreme simplicity of the latter, that the maintenance charges for the self contained car system will be greater than for the straight electric. The mainenance cost may reasonably be expected to be about midway between the electric car and the steam locomotive.

The operating costs of the several types of self contained cars will naturally vary among themselves, but in all instances such costs, exclusive of interest on the investments, will be materially higher than the straight electric, and in most cases, the costs, including interest charges, will favor the straight electric.

This reasonably follows in view of the high efficiency of the modern power station and transmission systems of electric traction, and also because of the high weight-efficiency of electric cars. The independent motor car must not only drag along its own power plant but it must sacrifice valuable remunerative space in order to carry it. For the same remunerative capacity, the self-contained car will weigh from 50 to 100 per cent more than the standard electric car. Under the same conditions of track, speed and distance the energy consumption required to move cars of any sort will vary as their weight, whence it follows that the energy consumption of the self-contained car will be from 50 to 100 per cent greater than the electric car.

The labor expense of practically all types of self-contained cars will be 50 per cent and upwards, greater than the straight electric for the reason that in addition to motorman and the conductor, a skilled mechanic is necessary for the operation of the power generating apparatus in each of the self-contained cars. This attendant is usually paid 30 to 40 cents per hour, or from 50 to 100 per cent higher wages than the ordinary platform men receive.

All self-contained cars, excepting those equipped with storage batteries, must have prime movers of sufficient capacity to suitably accelerate the cars and since the power required for accelerating is from two to four times that for full speed running and also because of the intermittent power demand in railway service, it follows that the average load on the prime mover will be but a fraction of its rated power, hence the efficiency of engine operation, whether steam or gasoline, must be low. This condition is worse with gasoline engines which have no overload margin, and in such cases, the average load will probably not exceed 40 per cent. Where a floating storage battery is carried on the car, it is, of course, possible to use a smaller engine and to work it at close to its rating most of the time, and the fuel cost per ton mile of such a car would be somewhat less than that of one without a battery.

The St. Joseph Valley locomotive with single trailer, during the early days of its operation, averaging 66 miles per day, consumed 50 gallons of gasoline per day. This reduced to a train mile basis is as follows:

Fuel at 16 cents per gallon	12.
Labor, 75 cents per hour	3.4
Acid, water, waste, sundries	.6
	16. cents

H. M. Beardsley published in the "Street Railway Review," July 15, 1905, page 438, a very complete table of operating statistics of electric roads in New York state. A study of this shows that straight electric operation per car mile is much less than the above figures, and if the comparison be made on the basis of cost per car seat, or unit remunerative space, the showing will be still more in favor of the straight electric cars. The average of 10 roads in the table is as follows:

Power	2.629
Wages of Conductor, Motorman	4.146
Car Service Supplies	.109
Miscellaneous	.16
	7.044 cents

Operation.

Comparison between a single concrete case and an average of a lot of widely varying cases, while giving an indication, is not convincing, therefore it may be of more interest to compare briefly the requirements and performance of a gasoline-electric car, and a straight car for transporting a given number of passengers, under the same conditions of distance, time, stops and road-way. Assume a line 25 miles long, standard steam railroad construction, stops of 15 seconds duration each, to average one every three miles. It is desired to operate a car seating 48 passengers, making the run one way in one hour.

Let us take the Delaware & Hudson R. R. car previously mentioned and recently described in the "Street Railway Review." It has been recently described in the technical press, but no hint of its detailed performance published, so we must rely upon calculated performance. This car weighs about 125,000 lb., and the car body, 65 ft. long over all, is of the combination type, with passenger and smoker compartments, seating a total of 40 passengers and with a baggage-express compartment. The engine is at one end, and the motorman's compartments with controlling apparatus at each end for operation of the car in both directions. Power is supplied by a 160-h. p. gasoline engine, direct connected to a 120-kw. separately excited generator. A small 5-kw. generator furnishes the excitation. The motor equipment consists of two 200-h. p. each, standard railway motors with two series parallel controllers. The generator output is limited by the capacity of the gasoline engine. The controllers, besides the usual connections for changing motors from series to parallel, also have connections for changing the voltage of the generator through its excitation. The acceleration and speed regulation of the car is then governed by the voltage of the generator and not by the usual method of resistance, in series with the motors.

A standard interurban car, about 45 ft. long, will seat comfortably 48 passengers, and will weigh fully equipped 24 to 28 tons. With four 50-h. p. motors, geared to about 35 to 38 m. p. h. maximum speed, and with normal trolley voltage, such a car will perform very satisfactorily the service outlined.

In the Fig. 1 are two curves, showing the schedule performance, which might be expected of the two cars—B referring to the gasoline-electric car and A to the standard interurban car. Incidentally, it is interesting to observe that as the frequency of stops increases, the self-contained car falls much more rapidly away from the schedule than the straight electric. Thus, at one stop

per mile, it can make an 18¾-m. p. h. schedule, while the straight electric can do 21¾ m. p. h.

Under the conditions assumed, the rate of energy consumption of the straight electric car will be about 60 watt hours per ton mile at the motors, and this value will be used as applying to the combination, self-powered car, although as a matter of fact, the input to the latter will be somewhat higher owing to its slower rate of acceleration and would more than offset the elimination of rheostatic losses in the motor control.

Manufacturers of gasoline engines of the size under consideration generally claim 10 h. p. hours output per gallon of gasoline at full load, but will guarantee only 8 h. p. hours per gallon of this fuel. In the calculations which follow, no account will be taken of the rapid falling off in fuel economy at fractional loads, so in using the 8 h. p. hour per gallon value, the error, if any, is in favor of the gasoline outfit.

Electric power station performance is well known from numerous published or otherwise available records. The following is typical of a 4,000-kw. turbine, water-tube boiler plant with coal at $1.60 to $1.80 per ton:

Coal	$ .0034
Labor	.0016
Maintenance	.0007
Supplies	.0003
Cost per kw. h. at Switchboard	$ .006

A well operated plant with fairly good load factor should encounter little difficulty in producing power at this figure; indeed

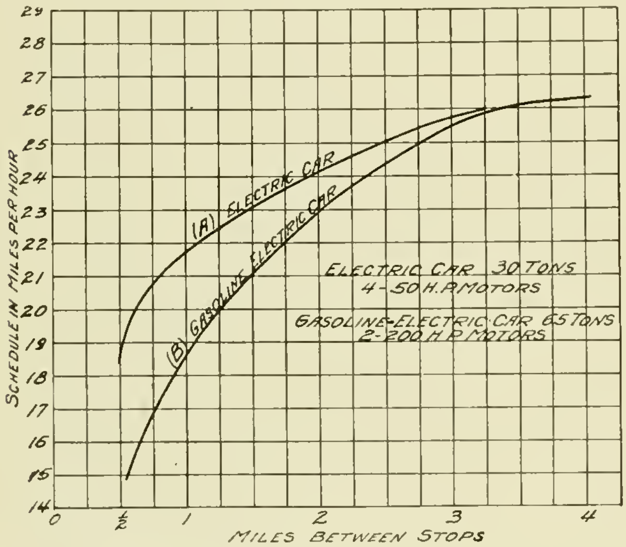


FIG. 1. CURVES SHOWING SPEEDS OF TWO TYPES OF CARS WITH VARYING NUMBERS OF STOPS.

many show much better results. For the purposes of this discussion, however, a higher figure, .0085, will be taken. This value is easily attained by most of the interurban power plants in the middle West.

Transmission efficiencies to the motors will be taken to average as follows:

	Alternating Current per cent.	Direct Current per cent.
Step-up Transformers	96	96
Line	97	97
Step-down Transformers	96	96
Rotary		88
Car Transformer	96	
Feeder and Trolley Net-work	93½	89
Net Efficiency	80	70

GASOLINE-ELECTRIC CAR, 62½ TONS.

62½x60=3.75 kw. h. per car mile.

3.75x25=94 kw. average per trip.

94 kw.=78 per cent of 120 kw., the rating of the generator and at this average load, generator efficiency equals 90 per cent, approximately

Then 3.75÷.746x.90=5.6 h. p. hours per car mile.

The engine will develop at full load about 8 h. p. hours per gallon of gasoline.

With fuel at 10 cents per gallon power costs 10x5.6÷8=7 cents per car mile.

The wages of the car crew, per hour would be motorman and conductor, 21 cents each; mechanic, 33 cents, or a total of 75 cents per hour.

75÷25=3 cents per car mile.

Waste, oil and small supplies, 60 cents..

STRAIGHT ELECTRIC CAR, 30 TONS.

30x60=1.80 kw. h. per car mile.

1.80x25=45 kw. average per trip.

Power at interurban generating station costs $.0085 per kw. h. at the busses; taking transmission efficiency to the motors at 80 per cent, alternating current system, then 1.80x.0085÷80=1.91 cents per car mile.

The wages of the car crew per hour would be motorman, 21 cents; conductor, 21 cents, or a total of 42 cents; 42÷25=1.68 cents per car mile.

For sub-station attendance, add .01 cents, and the total is 1.69 cents per car mile. Waste, oil, small supplies, 55 cents.

	Gasoline Electric.	Straight Electric.
Power	7.00	1.91
Labor	3	1.69
Supplies	.6	.55
Cost per car mile, cents	10.60	4.15

These are comparative costs per car mile, exclusive of maintenance and of general expense and are subject to considerable variation under varying conditions. The Union Pacific car, which weighs about 29 tons, has unofficially been stated to consume one-half of a gallon of gasoline per car mile in service involving much fewer stops. The Strang gasoline-storage-battery car, weighing approximately 37 tons, consumes according to official statements of the builders .45 of a gallon of gasoline per car mile. No statement of service conditions is given with this figure, but it is inferentially taken from the run from Philadelphia to Kansas City where the stops were very infrequent, probably less than 1 in 20 miles.

As a check on our calculations this data is interesting: The gasoline consumption per ton mile is about as follows:

Delaware & Hudson Car	.0112 gal.
Union Pacific Car	.0168 gal.
Strang Car	.0118 gal.

It is not intended to compare these three types of independent motor cars, for such comparison would be manifestly unfair, unless one took into account all the factors entering into construction and operation of each of the cars. It is intended to show, however, that the calculated performance of the Delaware & Hudson car includes a margin favoring the independent motor car as compared with the standard electric.

Initial Investments.

To get down to the gist of the whole problem and to see the influence of the initial investments on a given proposition, we will investigate two cases; the first between the gasoline electric and the standard electric and the second between these and steam railway service.

The first proposition contemplates the average interurban condition and may represent the competition between two paralleling roads for the local passenger and light traffic business which is assumed to demand cars at one hour headway from 6 a. m. until 12 p. m. or 18 hours service. The item of cost and maintenance common to both roads will not enter into the present consideration, and we will assume that the general expense of administration, engineering, taxes, insurance, etc., will be the same in both. We will take the same service conditions as before, that is 25 miles of road, stops every three miles and one hour for the run.

The single-phase system is well adapted to such service and will be considered in the following. It would be entirely feasible to operate with a generating plant in the center of the line feeding 6,600 volts directly to the trolley, eliminating high-tension transmission and sub-stations and thereby effect a saving in the assumed case of approximately $16,000. But it might be necessary because of water supply, coal, etc., to build the power house at

one end of the line and thus necessitate a sub-station. In order to be entirely fair to the gasoline car, let us assume this extreme condition.

Two cars will normally handle the service, but for special days requiring half-hour headway and for reserve, four motor cars and two trailers will be purchased. The normal daily mileage will be 900

Estimated Cost of Straight Electric System.

Power Plant	45,000
One Sub-Station	2,000
Distribution System	48,000
Four Motor Cars and two Trailers	36,000
Rail Bonding	6,250
	$137,250

Interest and depreciation at 10 per cent, $13,725, or $37.60 per day.

Estimated Cost of Gasoline-Electric System.

Four Motor Cars at $17,000	$68,000
Two Trailers at $3,000	6,000
	$74,000

Interest and depreciation at 10 per cent, $7,400, or $20.30 per day.

The maintenance of electric cars and plants per car mile can be gotten fairly well from the many published records, but that of the self-powered cars is at present a matter of guess. It will be taken at four cents per car mile which is roughly one-half the average maintenance charges of steam locomotives per mile.

Operation Costs.

	Gasoline-Electric.	Standard Electric.
Power	7.	1.91
Car Crews	3.	1.68
Supplies	.6	.55
Maintenance, Equipment and Cars	4.	1.5
Maintenance Plant and Distribution System		.5
Operating Cost per Car Mile, Cents	14.6	6.05
Daily Cost.		
Operation	$131.40	$54.45
Interest and Depreciation	20.30	37.60
	$151.70	$92.05

Thus, the difference in favor of the straight electric under the conditions assumed would be $59.65 per day or approximately $22,000 per year.

Consider now, an existing branch of steam road where the passenger traffic is light. Service must be given even if without profit, indeed many such branch lines are now operated at a loss, so far as the passenger and light traffic is concerned. The problem then is to find the cheapest means of handling the business.

Let us take the same length of line, frequency of stops, etc., as before, but add the condition that four trains each way per day will handle the business. We will assume that the train crews, when not on the passenger runs, are kept employed elsewhere on the system. The steam service would call for two light locomotives and four passenger combination cars. The self powered and the straight electric would each require two motor cars and two trailers. The trailers would not be used during the normal service, but would have to be purchased and kept to meet the demands of Sundays and special days.

It is assumed that the roundhouse, repair shop and water tanks would about balance the cost of electric carhouse and repair shop. Omitting then, as before, all factors of cost and operation common to all three systems, we will have:

Estimated Investments for Steam Service.

2, 45-ton Locomotives with Tenders	$16,000
4, Passenger Coaches	16,000
	$32,000

Interest and depreciation at 10 per cent, $3,000, or $8.78 per day.

Estimated Investment for Straight Electric Service.

Power Plant	$ 27,000
Sub-Stations	1,500
Distribution System	48,000
Two Motor Cars and two Trailers	21,000
Rail Bonding	6,250
	$103,750

Interest and depreciation at 10 per cent, $10,375, or $28.50 per day.

A plant of this size would not produce power as cheaply as the larger ones previously considered. The cost per kw. h. is taken at 1½ cents per kw., whence we have:

Power	3.38
Labor (as before)	1.69
Supplies (as before)	.55
Maintenance (as before)	2.
Cents per car mile	7.62

Estimated Investment Gasoline-Electric Service.

Two Gasoline-Electric Cars	$34,000
Two Trailers	6,000
	$40,000

Interest and depreciation at 10 per cent, $4,000, or $10.90 per day.

The steam train will consist of the locomotive, tender and two

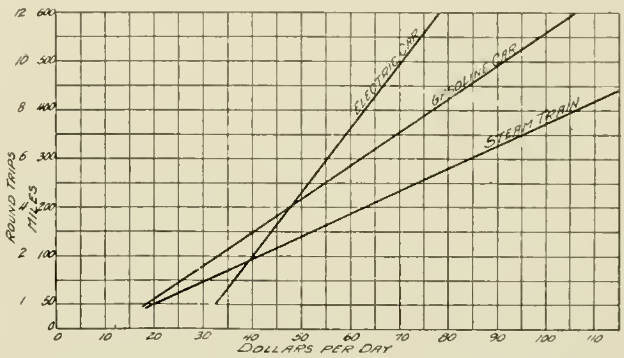


FIG. 2. COMPARATIVE OPERATING COSTS FOR THREE TYPES OF CARS.

cars, giving a train weight of approximately 110 tons. Under the assumed conditions of schedule, stops, weight, etc., such trains will require about 55 watt hours per ton mile, i. e., .0735 h. p. per ton mile. In such service the locomotive would burn about 7 lb. of coal per h. p. hour, and if this coal cost $2.25 per ton, the train-mile cost would be approximately:

	Per hour
Engineer	.35
Fireman	.21
Conductor	.30
Brakeman	.175
	$1.035
Power	6.35
Maintenance Locomotive and Cars	8.
Supplies	2.
Round House Expenses	1.
Train Crew	4.15
Cost, per train mile, cents	21.5

The daily operating costs exclusive of those items which are common to all the systems would then be:

	Steam.	Electric.	Gasoline.
Operation	$43.00	$15.34	$29.20
Interest & Depreciation	8.78	28.50	10.90
Total	$51.78	$43.74	$40.10

As the same equipment and therefore the same investment would be needed for a few trips more or less, and applying the same unit of operating costs per car mile and the same fixed charges we get the following daily costs:

Round trips.	Mileage.	Steam.	Electric.	Gasoline.
Six	300	$73.29	$51.36	$54.70
Five	250	62.53	47.55	47.40
Four	200	51.78	43.74	40.10

Three. 150	41.03	39.93	32.80
Two. 100	30.28	36.12	25.50
One. 50	19.53	32.31	18.20

This brings out clearly, that in the assumed case, the gasoline car is cheapest under six round trips per day, while the electric system is the cheapest at six trips or more per day. See Fig. 2. Generally speaking, the gasoline car will show a saving over the steam train in light, infrequent service, but when the frequency begins to approximate 2½-hour headway between trains, the electric car is undoubtedly the cheapest and becomes increasingly so with the increase of traffic frequency.

It is not the purpose to discuss the important subject of external transmission circuits within the limits of this paper, but it is well to point out that the progressive men in heavy railroad work no longer look upon the electric power conductor with the doubt and misgiving, not to say scorn, with which they regarded it a few years ago. The overhead trolley has demonstrated its reliability and sturdiness on thousands of miles of electric roads, in all conditions of weather and seasons. But until very recently, low operating voltage limited the use of the trolley to light interurban service. The third-rail, while it has splendidly performed its functions of showing the possibilities of heavy traction, is for many reasons hardly suited for surface work, although well adapted for sub-way or elevated roads. The advent of the single phase system permitting the use of high trolley voltages and hence moderate sized power conductors and bow trolleys has brought the overhead trolley conductor into the field of heavy railroading and, with the large eastern roads setting the pace, the early electrification of the present steam lines will come.

Conclusion.

Managers of steam railroads entrusted with the direction of large interests, are naturally very conservative and therefore slow to make what would appear to be radical changes in their equipment. Thus while they realize the limitations of the steam locomotive in suburban and interurban service they will, before stringing the trolley wire over their tracks, try out pretty thoroughly the independent motor car, which holds out alluringly the suggestion of interurban service without the power house, without the track bonding and without the external transmission circuit. This try-out will definitely establish the true field of the self contained car.

As to prospective interurban roads which are promoted with the view to using the gasoline or other types of independent motor, it is highly desirable to go slow and investigate. Broadly speaking, if a prospective road is to depend for revenue only on its passenger and light express traffic and the business only warrants one-half or more hours headway between cars, it becomes very much of a question whether or not the road will pay or ought to be built at all.

But this brings us into the realm of interurban railway economics, concerning which much less even than railway engineering it is not well to generalize. Each individual proposition should be independently examined and passed upon by a competent engineer, who should determine the equipment best fitted for it.

In city service, the independent gasoline car will find only the remotest application. Under certain conditions of power plant arrangement and operation, there may be isolated instances where the independent car might be called upon to handle the "Owl" service in the small hours of the morning. It may also be used on such streets on which the municipality prohibits the laying of tracks. Indeed, such cars are already in operation on Fifth Ave., New York. In such service, the independent car will probably displace the trackless trolley cars, which are in use in some European cities.

In conclusion, the writer believes that the independent motor car will prove a useful transportation medium. Its field will be distinct from that served by the standard electric system. Reduction in operating cost of the independent car, must come about through cheaper fuel and smaller labor cost. As we all know, the price of gasoline is constantly increasing. Kerosene engines and alcohol engines are frequently spoken of, but as yet, can not compete with the gasoline engines. The reduction in labor expense is not very promising. Advance and improvement in the art of building independent motor cars will undoubtedly be made, but at the same time, it must be borne in mind that the electric system will by no means stand still, and if its future progress be judged by that of the past, it will undoubtedly become the pre-eminent, if not the universal transportation medium.

Report of the 24th Annual Meeting of the American Street Railway Association.

The report of the 24th Annual Meeting of the American Street Railway Association, which was held at the Philadelphia Museum, Philadelphia, Pa., Sept. 27-28, 1905, has recently been issued by the secretary, Mr. B. V. Swensen. It will be noted that the name of this association has been changed to the American Street & Interurban Railway Association.

The report contains 453 pages and is a complete record of the transactions of the convention. There are included, the opening address of President Ely and the complete minutes of the various associations. The various papers read before the convention are given in full as are also the reports of the various committees. The report closes with an extended account of the very enjoyable banquet which was held in the Bellevue-Stratford Hotel. Much praise is due to Secretary Swenson for his very creditable work in preparing this report.

Standing Committees of the American Street & Interurban Railway Engineering Association for 1906.

Through the courtesy of Secretary S. Walter Mower, of the American Street & Interurban Railway Engineering Association, we are able to present a list of the standing committees for 1906 which have recently been appointed by the association.

The committee on shop records and accounts is a joint committee, two members of which are appointed by the Accountants' Association and two members by the Engineering Association. No work has been done by this committee since the St. Louis convention in 1904, at which time an excellent report was presented in which splendid results were shown. Since both associations have a considerable amount of work on hand for the current year, no report will be presented this year. The chairman for the representatives of the Engineering association is H. H. Adams, superintendent of shops, the United Railways & Electric Co., Baltimore, Md.

The committee on standardization is composed of H. H. Wallerstadt, engineer of car equipment, Interborough Rapid Transit Co., New York; F. H. Lincoln, assistant general manager, Philadelphia Rapid Transit Co., Philadelphia; H. A. Benedict, mechanical and electrical engineer, United Traction Co., Albany, N. Y.; Paul Winsor, chief engineer of motive power and rolling stock, Boston Elevated Railway Co., Boston; W. H. Evans, master mechanic, Indianapolis Traction & Terminal Co., Indianapolis, Ind; H. H. Fleming, superintendent of maintenance of way and structures, Chicago City Railway Co., Chicago, Ill., and J. M. Larned, engineer maintenance of way, Pittsburg Railways Co., Pittsburg, Pa.

The committee on controlling apparatus is composed of J. S. Doyle, superintendent of car equipment, Interborough Rapid Transit Co., New York; Hugh Hazelton, electrical engineer, The Hudson Companies, New York, and John Lindall, superintendent of motive power and machinery, Boston Elevated Railway Co., Boston.

The committee on maintenance and inspection of electrical equipment is composed of William Pestell, general manager, Worcester Steel Foundry Co., Worcester, Mass.; J. S. Doyle, superintendent of car equipment, Interborough Rapid Transit Co., New York, and W. D. Wright, superintendent of equipment, The Rhode Island Co., Providence, R. I.

The committee on maintenance of way is composed of F. G. Simmons, superintendent of construction and maintenance of way, The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.; W. B. Reed, New York, and R. L. Crump, engineer, Ford, Bacon & Davis, Memphis, Tenn.

The committee on insurance is composed of R. B. Stearns, superintendent, Northwestern Elevated Railway Co., Chicago, Ill. Mr. Stearns has been appointed a representative, by this association, to serve on the committee of the American Street & Interurban Railway Association.

Third Annual Meeting of the Iowa Street & Interurban Railway Association.

The sessions of the third annual convention of the Iowa Street & Interurban Railway Association were held at the Kirkwood Hotel in Des Moines on April 19th and 20th. The morning session of the first day was opened with an address of welcome by H. H. Polk, president of the Inter-Urban Railway Co. of Des Moines. In a few well chosen words Mr. Polk expressed the pleasure of the managements of the Des Moines street and interurban properties in having as guests the members of the association.

George B. Hippee of Des Moines, president of the association, then delivered the following address:

Address of President George B. Hippee.

Gentlemen of the Iowa Street & Interurban Railway Association, we are much gratified to greet you again at the third annual session of this association. Three years ago a few venturesome men in a small way started this association. At first your secretary had the very poorest encouragement. Up to our last year's meeting it seemed impossible to get any but the few to take an interest, but Dubuque seemed to be the entering wedge to wake up some of our tardy brothers. This year your secretary has prepared a program of more than usual interest, and one of subjects that directly appeal to the practical working side of us all.

The American Street & Interurban Railway Association is a good thing, and all should be members of it, and it is one of the big factors in the present street and interurban railway development and affairs, and can do much good, but it is so big that it is startling to some of us in its immensity. Being operators of small properties, we encounter the propositions and problems that interest the large city companies and are lost in the big sea of possibilities. We are not used to such big boats as they sail, and feel that we cannot be entirely taken care of in the discussions of the larger association. Such little ventures as ours seem lost in this large organization. But here in your home state you should unite forces, every one of you who is interested in traction problems. Give us the benefit of your ideas and thought. Some kink that is good for you is good for your neighbor. Find out what he is doing. Make a trade of ideas with him. You both will go away sure that you have made a good bargain, and each be a gainer

The acts of our legislature affect us all alike. During the past winter there have been few issues or changes suggested, but these were important to some, if not all of us. A new vestibule law was proposed. Another bill that meant much to a number of roads in this state was the proposed "Sunday closing law." To the companies that had baseball grounds, summer parks or gardens with music this meant much. This law was advocated as a great moral issue. Summer Sunday amusement parks are one of the most potent factors in the promotion of temperance. Amusement and the desire for intoxicating liquors do not go together. The police court records will bear out the statement that where Monday was formerly the big day in their courts, since Sunday amusements have been in force, it is one of the small days of the week.

Summer parks properly conducted, well policed, well lighted, where all know that there is one inflexible rule that will always be enforced—that every one must conduct himself as a lady or gentleman—are sure to have good results and the moral taught will be good, not bad.

There is another living question that confronts each man interested in any kind of a corporation today, and especially quasi-public corporations, and that is the spirit of semi-communistic sentiment that is sweeping over the country. There is no form or idea for civic improvement advanced by the present day reformers that is open to any but the chosen few. The reformers do not believe that any of us can have honest motives, or that we would welcome any improvement that would better the civic or political situation of the today village or city. They do not believe that we would be anxious to foster and promote some system that would protect us from graft. If the reformer could learn that we are much interested in good government, anti-graft and in the building up of our respective localities, all would be better.

The plain, hard, common sense of the American people is always right. Make these people your jury. Show them the fallacy of these world teachers, and their verdict can be only one thing—right and justice—and that is all we ask. We are here to

DELEGATES TO THE IOWA STREET & INTERURBAN RAILWAY ASSOCIATION AND PRIVATE PARLOR CARS OF THE INTER-URBAN RAILWAY CO.

serve the people, to give them the best service we can. Keep up with the growth of our towns; in fact, we are expected to keep a little ahead of the growth, and we should do so. All we ask is for the community to help us. Every improvement we make helps all the people as well as ourselves.

We are entitled to a fair profit. Ours is as legitimate a business as any other. We may have made mistakes in the past, but who has not? The future is before us. Let us all get together on common ground. Lock all switches and side-tracks that lead to the musty past, that breed dissension and discord; stick to the "Build-up" car that does not head to "Knockerville," but goes direct to "Get-Together-and-Get-There-Town."

F. J. HANLON.

L. D. Mathes, general manager of the Union Electric Co. of Dubuque, read his report as secretary-treasurer of the association, and presented the minutes of the second annual meeting held at Dubuque last year.

The first paper read at the convention was that of John F. Ohmer of Dayton, O., on "Transfers." Mr. Ohmer's paper, which will be found on page 290, brought out an interesting discussion of the methods of handling transfers on the different Iowa roads. It was shown that a transfer has an actual cash value until its time limit has expired, and therefore proper methods should be used to check the number of transfers issued and keep a careful record of when they are given out and collected.

The afternoon session opened with the reading of a paper by Roger W. Conant on "Rail Bond, Field and Armature Testing." This paper will be found on page 248. In the discussion of Mr. Conant's paper some interesting methods of testing were described.

When questioned Mr. Conant outlined the history and progress of bond testing methods from the use of the crude early forms of apparatus which had capacity for but 10 joints per day, to the present more accurate bond-testing machines with which as many as 1,000 bonds can be tested in a day. When questioned regarding soldered bonds the speaker described a novel bond of this type which had afforded five years of good service in Syracuse. The terminals of these bonds consisted of copper washers soldered and pin-fastened to the rails. When such washers had been secured on either side of the joint a connection of flexible copper was soldered to them.

In regard to testing and inspecting motor coils, F. W. Hild suggested that a simple way to discover whether or not there were short-circuits or other defects in such coils could be had by the use of a thermometer. If after an average run the temperature of the coils was not higher than 55° to 65° C. above the surrounding air, the motor would appear to be in good condition. Should the temperature rise be greater than this, there would undoubtedly be found some fault in the winding or that the gear ratio was too high.

H. B. Noyes described interesting methods which are in use at the shops of the Omaha & Council Bluffs Street Ry. By means of wattmeters on the cars he has found that when operating under usual conditions and fully loaded the average load on the motors is about one-third of the rated capacity. In order to determine the comparative condition of two motors on a truck without too much trouble in testing, 500-volt voltmeters are connected to the armature leads in the controller box. With the controller handle set on the fifth point, placing the two motors in series between the 500-volt trolley and the ground, a comparison of the effective magnetic flux through the armatures of the two motors is obtained. The readings on the voltmeters are proportional to the field strengths of each motor, since the speed and number of conductors of each motor are the same. Therefore, as the magnetic properties of one motor vary, its electromotive force will vary proportionally, and the ratio of the magnetic value of each set of field coils will be shown by the ratio of the voltages as read on the two voltmeters.

In the Omaha shops, when there are on hand quite a number of field coils and it is desired to find out whether or not they should be rewound, the following method is used: A series of such coils is arranged and about 60 to 75 amperes of current passed through all the coils of the series, one of which is a new and perfect coil. When the coils have all been heated to about operating temperature the current is cut down so as to maintain this temperature. A portable voltmeter with a 15-volt scale has its terminals connected with a double-pole, double-throw switch, so that these terminals may be quickly connected with the terminals of the new field coil or the terminals of one of the old coils in the same series. With the coils heated to operating temperature, voltmeter readings are taken first across the terminals of the new coil and then across one of the old coils. Should the old coil have the same voltage reading, under these conditions about one-half scale or seven and one-half volts, one of the operators stands on the coil and brings his weight to bear in different directions. Thus if there is any defect in the interior insulation, this pressure short-circuits one of the terminals and varies the voltmeter reading. Whenever the voltmeter readings of an old coil are within five per cent of those of the new coil, this old coil is considered as having satisfactorily passed the test.

J. G. Huntoon, general superintendent of the Tri-City Railway Co., Davenport, Ia., next presented a paper on "Discipline of Car Service Employes." Mr. Huntoon's paper will be found on page 253. In the discussion of this paper and the merit system of discipline, the adaptation of this method was discussed by members representing the city properties at Clinton, Dubuque, Waterloo, and the Iowa & Illinois interurban line connecting Clinton and Davenport.

Mr. Mathes stated that whenever an employe of the Dubuque property performs an especially commendable act, he is given a substantial reward. The amounts presented in each case vary according to the services performed, and in some cases have reached $50 and $75.

During the afternoon session the members of the Iowa Street & Interurban Railway Association adjourned temporarily to another parlor of the hotel where the Iowa Electrical Association was in session in order to listen to an able discussion on "The Political Status of Rate Regulation" by the Hon. M. J. Wade, of Iowa City.

The Friday morning session opened with the presentation of a paper on "The Gasoline Car for Interurban Service" by F. W. Hild, chief engineer of the South-Western Wisconsin Ry., Dubuque, Ia. Mr. Hild's paper will be found on page 240.

The discussion of this paper was especially interesting and some new ideas were brought out. When questioned Mr. Hild stated

DERRICK AND PILE DRIVER CAR LOADING RAILS.

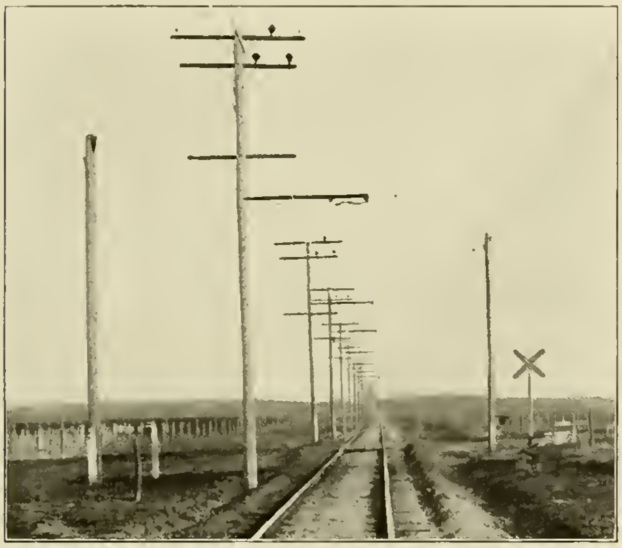
that investigation as to the cost of operation alone, for a rural line about 25 miles long, showed that with six or more trips a day, this being a three-hour headway, the electric service is the cheaper. On fewer trips than this the gasoline method of operation has the advantage, these comparisons being based on the cost of a gasoline-electric car rather than a straight gasoline.

It was suggested by Mr. Hippee that gasoline motor cars suitable for operation without a track might have a good field as feeders for present electric lines.

A. P. Jenks described some of the construction details of the

Delaware & Hudson gasoline-electric car recently built by the General Electric Co. The car complete weighs 62½ tons and half of this weight is car body and trucks. The six cylinders of the engine are 10 x 10 in. in dimensions and the engine runs at 425 r. p. m. The car has not met the earlier expectations as to speed on account of the weight and the engine developing but 160 h. p. when it was expected to furnish 200 h. p. It was stated that the cost per mile for operation of the so-called trackless trolley cars is about 22 cents and that the tire cost is quite large.

W. R. Garton of Chicago, Ill., next presented a paper on "The



TRACK SCENE ON THE BEAVER VALLEY DIVISION.

Mutuality of Interest of the Operator and the Supply Man." This paper will be found on page 284.

Friday afternoon George H. Tontrup of St. Louis, Mo., delivered a paper on "The Standard Car Body and Truck." This paper will be found on page 281. In the discussion of this paper it was brought out that a suitable substitute for the veneer car ceiling is being found in the use of sheet steel. In the cars of the Des Moines city and interurban properties the ceilings are made of narrow matched hardwood of a suitable thickness. With such material and when nicely varnished a car ceiling presents a pleas-

STOCK YARDS AT GRANGER, IA.

ing appearance as well as adding a factor of stiffness to the roof structure.

Before the closing of the annual meeting several tributes were offered President Hippee for the efficient work he has done in organizing and promoting the Iowa Street & Interurban Railway Association. At the first meeting there were but four roads represented. This number, contrasted with the attendance of the present meeting, at which all the roads in Iowa with the exception of four were represented, emphasizes the remarkable growth of the association under the guidance of Mr. Hippee.

The sessions closed with the announcement of the officers for the coming year as follows: President, F. J. Hanlon, secretary and auditor of the Mason City & Clear Lake Railway Co., Mason City, Ia.; vice-president, P. P. Crafts, manager of the Iowa & Illinois Railway Co., Clinton, Ia.; secretary-treasurer, L. D. Mathes, manager of the Union Electric Co., Dubuque, Ia.

At the urgent invitation of the managements of the electric and railway properties at Clinton and Davenport and the interurban property connecting these cities, it was decided by the Iowa Street & Interurban Railway Association and the Iowa Electrical Association to hold their next annual meeting at Clinton.

During the time of the convention the welfare of the attending members, supply men and guests, was especially well provided for by the Des Moines city and interurban railway companies. On Thursday evening a vaudeville performance was given at the Elks

SUB-STATION AT HERROLD, IA.—INTER-URBAN RAILWAY CO.

temple. This performance included several boxing and wrestling matches, and during the evening a luncheon was served in the balcony at the rear of the auditorium overlooking the stage.

On Friday afternoon directly after the close of the convention, about 75 members and guests were treated to a trip over the several interurban lines radiating from Des Moines to the east and northwest. Two special cars were provided and a dinner was served enroute in one of the cars, the "Iowa," which was described and illustrated in a recent issue of the "Street Railway Review." The accompanying illustrations will serve to show the high character of this successful property.

From eight until five o'clock of each day of the convention

STATION AT GRANGER, IA.

special cars were provided each half-hour for excursion trips to the power house of the Des Moines City Ry. On registering, each guest was given two complimentary mileage books, one for the Des Moines City Ry., consisting of coupons to be honored on all the city cars; the other book included a strip of mileage good for 250 miles of transportation on the lines of the Inter-Urban Railway Co. These mileage books had specially pleasing embossed covers bearing half-tone engravings of interesting views in and about Des Moines.

At the request of the association there were many supply men

at the convention, a number of the firms represented making extensive exhibits. Among these the street railway manufacturers and supply houses were:

W. R. Garton Co., represented by W. R. Garton and C. C. Ewing. "Lima" porcelain insulators, "Shaw" lightning arresters, "Thomas" bonds.

Atlas Railway Supply Co., represented by D. Thomson, with specimen joints for street and interurban tracks.

Electric Storage Battery Co., represented by J. A. White, who extended an invitation for a trip to inspect a working "Chloride Accumulator" plant at Newton.

Westinghouse Electric & Manufacturing Co., represented by A. M. Miller, H. H. Caughlin and W. R. Pinckard, exhibiting lightning arresters, meters and central station and railway apparatus.

National Brake Co., represented by E. C. Rutherford, with a full-size model of the "Peacock" brake.

American Steel & Wire Co., represented by George Quigley and George Long, exhibiting bonds and samples of wires and cables for all classes of work.

Porter & Berg, represented by E. R. Mason, W. D. Hamer and W. P. Cosper, with a very complete line of track and overhead materials including this company's new "Cyclone Track Drill" and "International Registers" and Garton-Daniels' "Automotoneer" and lightning arresters.

General Electric Co., represented by H. L. Munroe, E. L. Callahan, G. A. Seabury, Geo. W. Munroe and A. P. Jenks, exhibiting this company's line of "Indestructible Heating Devices."

Ohmer Fare Register Co., represented by John F. Ohmer, exhibiting the "Ohmergraph."

Allis-Chalmers Co., represented by Edwin Dryer, Chas. Brown and John Burke.

Bond and Motor Testing.*

BY R. W. CONANT.

The study of the history of rail bonding illustrates the fact that while some roads have practically solved this problem, others, probably the majority, are still making the history.

It should be noted that what may be found to be a practical solution on some roads is a very imperfect solution on others; first, because of the difference in the volume of the current, and second, because the mechanical and electrical difficulties on some roads are much more serious than they are on others. If the current is forced to overcome great resistance on its return to the power house, heavy losses of power will result; pipes may be corroded, car schedules slowed down, and motors will be overheated. A few badly bonded joints may easily introduce a large resistance into the return circuit, even though the majority of the bonds are perfect. On the other hand, a large number of poorly, but not badly bonded joints, will produce a like result.

The efficiency of a bonded rail joint is best stated as, so many feet of the adjacent rail, as is equivalent in resistance to three feet of joint and rail. If a joint is perfectly bonded up to the full capacity of the rail, the joint would then test equal to three feet of rail. This figure represents a highly efficient joint, being in fact electrically equivalent to a continuous rail. As the joint becomes less efficient its resistance increases and the test figure becomes higher. With perfectly installed No. 0000 double bonding on an 80-lb. rail, the usual test figure is found to be 4½ ft.

From 3 to 9 ft. may be considered good bonding. From 9 to 18 ft. is to be considered poor bonding. Above 18 ft. is bad bonding. While these definitions of the terms good, poor and bad are somewhat loose when dealing with any particular joint, they are accurate enough when applied to a large number of joints that have been tested on a certain stretch of track, to ascertain whether or not there is a great loss in the return circuit.

Let us suppose a case where the rails are in 30-ft. lengths and the joints have an average resistance of six feet of rail, then the total resistance of one mile of rail so joined will be equivalent to one and one-tenth miles of continuous rail. In this manner we may figure out the equivalent increase in length of any rail tested. In investigating the efficiency of individual joints, it is of course of great value to know the exact test figure. This coupled with the knowledge of what a joint so bonded should test gives all that is required to enable one to bring the bonding up to the standard.

A few standard figures may now be given showing what has practically been obtained in good bonding work. The cast-welded joint properly installed will test three feet of rail or better. Two 10-in. No. 0000 plug bonds correctly installed in a 90-lb. rail will test 4½ ft. One 6-in. No. 0000 bond soldered to 75-lb. rails will also test equal to 4½ ft. of rail. These are the initial test figures before the joints have been subjected to service. Since on any road there are so many joints (352 per mile of single track of 30-ft. rails) subjected to the varying conditions of motion, moisture, freezing, thawing, etc., a test taken in the spring following the first winter will give results of great value.

It will now be desirable to consider what difficulties are to be overcome in making perfect bonding, as disclosed by tests on the various styles installed under different conditions and length of service. Assuming that the bond has been selected of sufficient cross section, the next business is to install it so as to make good electrical contact with the rail. Here is where most bonds fail, for if the slightest crevice is left between copper and iron, the moisture will rust the iron surface in contact with the copper and prove fatal to the bond. If it is a pin-driven bond in which the terminal is a copper sleeve expanded by a steel pin then the pin must be of the right size as well as the terminal. A common defect in installation is to neglect to drive the pin at all.

In all protected forms that go between the fish plate and the web of the rail, sufficient room must be allowed so that no amount of drawing up of the fish plate bolts will jam the bond, otherwise loosening and breaking will result. If there is much movement of the rail, the bond must be long and flexible, while for rails that are solidly embedded in the pavement, a shorter bond will be sufficient.

The very considerable amount of track motion which often causes under fish plate bonds to be alternately stretched and pushed together is due to the transmission of the longitudinal movement by the firmly rusted joints to about every tenth joint which usually slips. The flexion in the copper strands takes place either at the bottom or top loop causing the bond strands to break, as will any piece of metal constantly bent backward and forward.

The peculiar feature of copper working out through the joints is not often met with, but the breaking of bonds is of rather common occurrence. The most common fault found in bonding is terminal trouble, due to rusting between the contact surface of the bond terminal and the rail. Almost any road whose rail bonds have not been looked after for a year or more will have from one-half to one per cent of its bonds defective and usually about 90 per cent of this trouble is due to moisture rusting the rail at the inner surface of the bond hole. The figures given of one-half to one per cent are to be taken as applying to roads using a plug bond under favorable conditions. Many roads are so poorly bonded that this percentage only, of good bonds would be found. Then of course there are roads whose condition of bonding falls somewhere between these two extremes.

A part of the return circuit, not thus far mentioned, that is particularly liable to trouble is the special work at railroad crossings, switches and frogs. At these points the difficulty of applying the regular bonds and the lack of knowledge of the proper way of supplementing the bonding has in the past caused severe losses.

It will probably be unnecessary to quote further examples of bonding defects, as enough has been said to show not only the necessity of adapting the style and method of bond installation to each condition of service, but also to show the value of intelligent testing. Without this, very little progress could have been made towards solving the bonding problem on electric railways. As to how far this problem has been solved, it is not too much to say that under the most unfavorable conditions of service, a road that will test and intelligently apply the results will have no difficulty in finding a style of bonding that will successfully meet all its requirements.

Motor Testing.

Taking up now the question of motor field and armature testing. In presenting this subject for your consideration it will be unnecessary to discuss the manufacturer's shop tests or any other motor tests excepting those that will directly enable you to better the operation of your motors.

*Read before the Iowa Street & Interurban Railway Association, Des Moines, April 19, 1906.

In making clear the reasons calling for such tests, we will have to go back a little into the history of the design of railway motors. The frequent burnouts were largely caused by insufficient protection against water. Improvement in design was made through the successive stages, until finally all motors for street service are now enclosed in a steel or iron shell.

At about the same time that these improvements were being worked out, the weights of the cars became greater, and schedule speeds higher, without a corresponding increase in the capacity of the motors. The result is that more heat is generated in the motor than can properly be taken care of and the well known deterioration of the insulation occurs. Low voltage on the line from one cause or another raises the average ampere hours of current used by the motor which is an additional cause of overheating.

The peculiarity about a railway motor is that a given motor may be able to withstand a load of 100 amperes for a few minutes without damage, but a continuous application of only a quarter of this amount of current would soon burn it out. During the past eight or nine years' service on the modern types of railway motors, it has been demonstrated that the final test of their capacity lies in the ability to withstand moderate currents for long periods of time rather than heavy currents for short periods.

As the motor windings deteriorate, the well known effects of armature flashing, overheating, bucking and burnouts occur. In the armature, on account of the high voltage applied and the current interruption at the commutator, any ground or short-circuit between coil turns soon shows up or else burns itself out and stops the operation of the motor. But with the field coils the case is a different one. Having no moving connection and being subjected to a low voltage because they are connected on the ground side of the armature, a fault or short-circuit between turns may exist for a long time without showing up while the motor continues in service.

But you may ask what harm does this do so long as the motor continues to operate. The answer is a good deal like the story of the Deacon's one-horse chaise, that when it does go, it goes all to pieces at once. As a matter of fact, it is worse because a short-circuited field coil weakens the magnetism, causing the motor to take excessive current and to spark at the commutator, both of which do great harm to the vital and undamaged portions of the windings. Thus you will see that unsuspected field trouble is communicated to the armature where it is manifested by burnouts. Many times these are not laid to the proper cause at all, and when the armature is replaced by another, the fields are not even tested.

Before taking up the subject of field testing, let us briefly discuss the subject of armature tests. The only test that is really of much value for an armature is to put it in a motor frame and run it as near as possible under service conditions. Experience has shown that a high voltage test, while it locates some of the armature faults, does not locate all, and that many times an armature will burn out but a few hours after passing this test. The running test in a motor frame shows up so many more of the armature defects than can be discovered by any of the simpler instrument tests, that it hardly pays to make these latter at all. This should be taken as applying to the average road of medium size. There are of course exceptional cases where this statement is not true.

On the average road the principal thing that can aid one in reducing the motor troubles and prolonging the life of the electrical equipment, including the controllers, is field testing. The prime defect in all field trouble is caused by some of the turns of the coil short-circuiting upon themselves. There are two principal causes bringing about this short-circuiting. First, baking by heat, and second, moisture. Let us first investigate the baking question.

The limited space beneath the trucks which is allowed for a motor, as well as its excessive first cost, usually prevents us obtaining a motor of sufficient size to do the work, without overheating. A large motor of ample design effectively radiates the heat as is seen in the case of the stationary shop motors.

In the case of a series railway motor, since all the current passes through armature and fields in series, the heat is generated in all parts of the winding in proportion to the square of the current and amount of the resistance. As the fields heat up, their resistance increases which in turn causes heat to be generated at a more rapid rate even with the same amount of current flow, so that this heating action is cumulative to a surprising degree. This overheating is not by any means confined to exceptionally heavy service, but takes place under ordinary operating conditions. Dry cotton, which is the basis of all the usual wire insulation, has but a limited life when subjected to this long continued baking. The highest temperature reached on each run in service impresses itself on the cotton, scorching it, as will a hot flat-iron on cotton cloth. On each succeeding run it scorches a little more, until finally the cotton is reduced to a brownish powder which crumbles and allows the bare wire turns on the spool to short-circuit. This weakens the entire field and the motor therefore takes more current to do the work, now piling up heat still more rapidly in both field and armature windings. The result is easily foretold.

If the defective field spool can by test be located and replaced, much of the damage will be prevented. It is worthy of note that on account of the cumulative action before referred to, it takes but a slight difference in ventilating conditions between spools in the same motor to make one of them, usually one of the top spools, short-circuit long before any damage has been done to the rest. This is contrary to the usual idea that all the spools are bad if one is bad. Where systematic testing has been adopted, this statement is borne out by the results in practice and much saving effected.

Tests of the resistance which have been somewhat relied upon to locate bad fields will seldom disclose the defect because the change in resistance of a field coil due to a short-circuit is very slight and is swallowed up by larger changes in resistance due to poor contacts, temperature variation, etc.

It is very important to have some method of testing the fields that does not involve skilled observation or calculation, that will plainly indicate whether or not a spool is faulty and without disconnecting the motor or car wiring and while the fields are still in the motor under service conditions. Even under the best conditions the ordinary heating that fields get, bakes the insulation and renders it brittle, so that if a spool is removed for test or for any other reason and put back into another motor the shaking up that it gets greatly shortens its life. But if the bad spool only is replaced, leaving the others undisturbed in their places in the motor, although they may be partially baked but not actually short-circuited, it is surprising how long they will last and continue to give good service.

An advantage of being able to test the fields while in the motor obtains from the fact that owing to the springing apart of the turns of stiff field wire when the field clamping plates are loosened some classes of defect apparently disappear. Occasionally it is advantageous to test the motors hot just as they come in from service, for the reason that certain rare but troublesome defects are thus located, while if the motor is allowed to cool off, the defect apparently disappears, but immediately occurs again as the motor warms up in service. This is due to the expansion of the copper by heat causing more pressure between the poorly insulated field turns which short-circuits the coil.

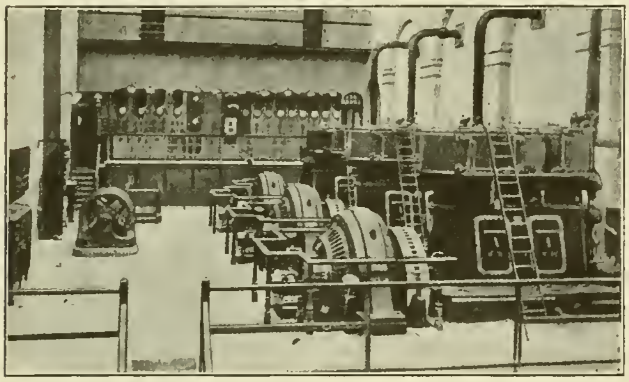
The difficulties arising from moisture entering the fields are often very troublesome, mainly for the reason that a field damaged by moisture shows no evidence of any deterioration on the outside. Even when stripped down to the cotton covered wire it looks white and new, but a test will disclose a bad short-circuit somewhere in the coil. It is usually the bottom spools which get the moisture and they are not subjected to so much heat as the top spools, consequently the cotton is not discolored on the outside. When, however, a layer or two of wire is unwound there is seen throughout a part of the coil a greenish discoloration. This is due to electrolysis of the copper and careful examination will disclose an electrically pitted place eaten through the cotton into the copper wire. This frequently occurs at one of the inside corners of the field spool, between two wires that short-circuit and cut out two or more layers of the coil. Moisture troubles are quite common with some types of motor, notably those which allow the condensation to settle near the bottom field spools.

The International Railway Co., of Buffalo, recently has made a considerable increase in the pay of its conductors and motormen. Fifteen thousand men are affected by this increase and the annual expense to the company has been thereby increased more than $100,000.

The Electric Tramways of New Zealand.

Those who are unfamiliar with Great Britain's prosperous colony of New Zealand, will be interested to learn that within the last few years well-equipped electric tramway systems have been installed and are operating in the four principal cities of the islands. These cities are Auckland, with a population of 75,000, Wellington, 60,000, Christchurch, 60,000, and Dunedin, 58,000. With the exception of the system in Auckland the tramways are owned by the municipalities. The lines have so far been well patronized but it is still somewhat early to obtain reliable data as to their profitableness.

There has been appearing in a New Zealand scientific publication known as "Progress" a series of interesting articles dealing with each of the four systems in turn. We are indebted to this publication for the data and illustrations which are here presented.



INTERIOR OF POWER HOUSE AT WELLINGTON

Auckland.

The Auckland Electric Tramways Co., Ltd., was formed in March, 1899, to take over the existing horse tramways, with a view to their extension and conversion to electric operation. Under the laws of New Zealand, no private promoter can apply directly for tramway powers, therefore the Auckland City Council obtained a charter for a tramway system and on June 28, 1900, it deeded its powers to the company. The concession has been granted for 32 years, after which time, the local authorities may purchase the undertaking.

In July, 1901, contracts were placed with J. G. White & Co., New York City, for the whole of the traction construction. The whole length of the line is 20 miles and certain portions have been double tracked. The gage is the standard 4 ft. 8½ in. and the distance between tracks is 6 ft. enabling center poles to be used to a large extent.

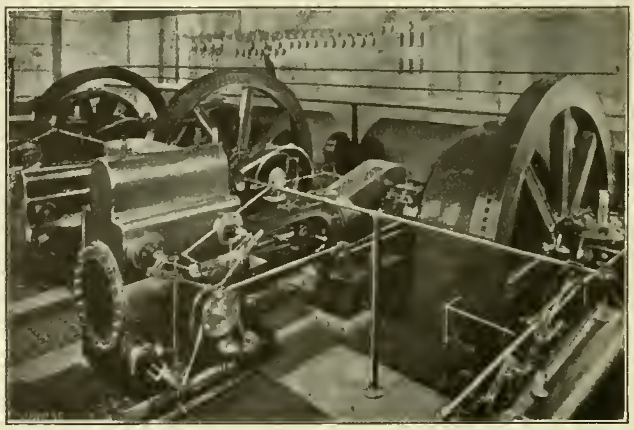
The rails used are the Lorain Steel Co.'s 92-lb. girder. For the inner rail on curves of less than 300-ft. radius, a 95-lb. section has been used. It was ascertained that 37 ft. was the greatest length that could be conveniently shipped from America where the rails were purchased, and it was accordingly fixed upon as the standard length. The fish plates are 24 in. long, weigh 52 lb. per pair and are secured by six bolts.

A high standard of roadbed construction has been followed. The rails are bedded to a depth of one inch in longitudinal concrete sleepers 18 in. wide by 9 in. deep. Between the sleepers, the roadbed is excavated to a depth of 9 in. and filled in with well-tamped macadam. As the rainfall at Auckland is extremely heavy and amounts to about 60 in. per year, a special system of draining the track was installed. Not only the rail grooves but also the whole width of the single or double track is drained. A narrow culvert with a concrete bottom and brick walls is placed across the full width of the track or tracks, a slot being cut out of the bottom of the groove of each rail to open into it. A suitable connection is made with the nearest surface water drain. These culverts are covered with stout iron grids. One of these drains is placed at the bottom of each grade, the average distance apart being about three-fourths of a mile. All special work is also drained.

It has already been noted that center poles predominate in the overhead equipment. Span-wire construction is used at curves and junctions and side poles and brackets have been used to a limited extent. Swivel trolley poles are used on the cars and the overhead work is arranged for a maximum reach of the trolley arm of 4 ft. 6 in. All center poles are provided with cast-iron wheel guards and as an additional precaution, are painted white for six feet above the ground. All poles are 32 ft. long over all. Three grades of iron poles are used, weighing 905, 1,295 and 1,435 lb. respectively. The wooden poles are of totara and are square in form, being tapered from 11 in. on a side at the bottom to 8 in at the top. All wooden poles are thoroughly tarred at the bottom for a distance of 7 ft.

The trolley wire used is known as No. S. E. and flexible suspension is employed throughout. The company was required to insulate all telegraph and telephone wires which cross its lines. Outside the central portion of the town, where the cables have been laid underground, the feeders, consisting of 3, 4 and 6 No. 0000 bare copper wires, are carried overhead on wooden cross-arms fixed to the poles. The telephone wires are carried above the feeder wires on small brackets. Wherever the feeders have been carried underground, they have been insulated with vulcanized bitumen and have been drawn through earthen ducts. The ducts are all single way and octagonal externally. They have been supplied in 18-in. lengths measuring 4½ in. outside diameter and having a 3¼-in. bore. The ducts are grouped together with a thin film of cement mortar between each pair and the whole is surrounded with a four-inch casing of concrete. The manholes are placed at an average distance apart of 270 ft. They are supplied in two sizes, 4 x 4 ft. internally, by 5 ft. deep and 2 ft. 5 in. x 3 ft. 5 in. internally, by 3 ft. 6 in. deep Only one size of iron frame and cover is used, the upper brickwork of the large manholes being racked to the required extent. The cover is recessed and filled with asphalt to a depth of 2 in. The ducts are laid with a slight fall so as to drain into the manholes and where the accumulation of water would be likely to be considerable, a connection is made between the manhole and the nearest sewer.

The rolling stock consists of 55 passenger cars and one freight car. The single-deck bogie cars are of the combination type with closed centers and open ends and are designed to accommodate 48 passengers. The double-deck cars have reversed staircases and four-motor equipments and will seat 80 passengers. The four-wheel cars are divided into a main and smoking compartment and will seat 32 passengers. In the double-deck cars, each truck carries two motors and in the single-deck bogie cars, one motor, provision being made in the latter case for the installment of a second motor. The wheel base of the single truck is 6 ft. 6 in. and that of one of the double trucks, 4 ft. The wheels are 30 in. in diameter. One standard size of motor rated at 40 brake h. p. has been adopted. The maximum tractive effort specified was 1,700 lb. at the wheel tread and the maximum car speed is 18 miles an hour.



INTERIOR OF POWER HOUSE AT AUCKLAND.

Each car is fitted with a hand brake, a track brake and an electrical emergency brake. The grades are very severe on some of the routes and efficient brakes and ample motor power are necessary.

The power station is constructed in two bays of about 53 x 104 ft., and is built of brick and steel. The roof is of corrugated iron laid over 1¼-in. boards. The present equipment comprises four Babcock & Wilcox boilers fitted with chain-grate stokers and Green economizers. There are three horizontal cross-compound, corliss engines rated at a maximum of 700 h. p. running at 100 r. p. m. with a steam pressure at the stop valve of 150 lb. per sq. in. To these engines are direct connected three 300-kw., 8-pole, continuous-current, compound-wound generators capable of 50 per cent overload. There are also one 600-kw. set capable of 1,000 h. p.; one 25-kw. auxiliary unit manufactured by the General Electric Co., and four boosters each consisting of a shunt-wound motor direct-connected to a series-wound generator. The switchboard is

CAR HOUSE AT DUNEDIN.

of blue Vermont marble and contains 14 panels. The power station is also equipped with a 20-ton overhead crane which is operated by hand from the floor.

The company owns two car houses which have been reconstructed and electrically equipped to accommodate 44 and 30 cars respectively. The principal shop is in two bays 354 and 328 ft. long respectively and each 139 ft. wide, containing the car shed, paint shop and erecting shop. There are 6 tracks in the car shed all of which have pits under their entire lengths. A third and smaller bay contains the machine and woodworking shop, the blacksmith's shop, winding room and store rooms. A cross-pit connects the machine shop with the car shed. Light rails are laid along the floor of all the pits with turntables at the junctions with the cross-pit. By means of wheeled hydraulic jacks the parts requiring repair can readily be transported from under the cars to the shops. The equipment of the repair shops includes an overhead crane, lathes, drilling machines and a 150-ton hydraulic wheel press. A car-lifting appliance of 15 tons capacity is provided which consists of two pairs of screw jacks on wheels and two girders.

In conclusion it might be mentioned that in 1904 the profits handed to the Auckland city council by the tramways company amounted to $11,500, in addition to $6,000 paid in street rents and taxes.

Wellington.

The tramway system of Wellington has now been in operation for nearly 18 months and there are at present, over 21 miles of single and double track open to traffic. The whole of the city track has been laid on a solid concrete foundation which provides a lasting bed. The rails are of the British standard section, 95 lb. per yard., 40 ft. long and bonded with No. 0000 stranded copper bonds. There are a number of sharp curves and crossing points with the result that the rolling stock is subjected to very heavy wear. The overhead type of trolley construction has been adopted. The trolley wire is of No. 0000 hard-drawn copper and is suspended from welded steel tubular poles.

The rolling stock consists of 41 cars and comprises box, double-deck and combination cars, all being painted in red and yellow. All the cars, with the exception of the combination type, are mounted on Brill 21-E trucks. The combination cars are mounted on double trucks of the same make. The motor equipment of each car consists of two 25-h. p. motors of the GE No. 54 type. In addition to this equipment five other cars are being constructed by the company.

The power station is situated on reclaimed land which is near the new coal wharf now in course of erection. The boiler room is 70 x 81 ft. in area and is well lighted. The equipment consists of three boilers of the Lancaster two-flue type, 8 x 30 ft. in size, which furnish steam at a pressure of 160 lb. per sq. in. Space has been provided for additional equipment and there are two new boilers in process of installation. The boilers are equipped with mechanical stokers into which the coal is fed from the bunkers by a series of motor-driven conveyors. The boiler feed equipment consists of two gun-metal pumps which have a capacity of 4,000 gallons per hour. A Green economizer and an auxiliary by-pass flue are also provided. There are two steam mains from each boiler, one leading direct to the 10-in. steam header and the other to a superheater set at the end of each boiler. The steam superheat is about 100° F. The power equipment consists of triple-expansion, high-speed, self-lubricating engines, direct-connected to 6-pole direct-current generators. Four units, one of 250 and three of 500 h. p. have been installed. Provision has been made for two additional machines and one of 1,000 h. p. has been ordered. The 250-h. p. set is used for municipal lighting and is also used from midnight to morning to aid in keeping up the current on the lines for the work of cleaning and repairing the cars. Of the three 500-h. p. sets, one is always idle while the other two take care of the traction load during the day. Steam at a temperature of 460° F. is used and so far has shown great economy.

The condensing plant includes three motor-driven centrifugal pumps which pump the sea water through a culvert into the pump room and thence into an overhead tank. The water then gravitates to jet condensers of the ejector type affixed to each individual engine. The engines are now working on a very small coal consumption. This fact, together with the economy of management of the works, results in the production of current at a price under three farthings (one and one-half cents) per unit.

The switchboard is of gray-blue marble and contains 15 panels. There is also a 15-ton motor-driven overhead crane.

The car shed is a brick building 384 ft. long by 101 ft. wide with a roof supported on steel trusses. Forty feet of one end of the shed is used for the various shops. The work shops are well equipped with motor-driven machine tools including a heavy turning lathe, a wheel lathe and a press. At the entrance to the car shed there has lately been erected a spacious brick car-building shop. South of the shed is a neat brick building which affords accommodations for the traffic staff and other employes. The offices of the chief engineer, accountant and clerical staff are in the town hall.

Since the completion of the city track considerable progress has been made in extending the lines to the suburbs of the city. The volume of traffic is daily increasing, the largest total reached for any one day in 1905 being 54,000 passengers. An estimate of the number of passengers to be carried during 1906 is given at 15,000,000.

Christchurch.

The electric tramway system of Christchurch which was opened for traffic on June 5, 1905, has the distinction of being the only system operating a 600-volt direct current south of the equator. The permanent way and overhead wiring are much the same as those in use at the other New Zealand cities. The gage is the standard 4 ft. 8½ in. When the whole system has been completed there will be over 29 miles of single track and over two miles of double track, the latter being within the city limits.

The rail used on the straight track is the 92-lb. girder type with the exception of about four miles where the line has been laid next to an arm of the Estuary. On this portion 72-lb. T-rails have been adopted. On all curves a 95-lb. girder rail has been used. The rails are all double bonded with the General Electric Co.'s ribbon bonds. The rolling stock consists of two-deck, double-truck cars, combination double-truck cars and four-wheel box cars with a vestibule at the end. There are 27 new cars, 22 having been constructed by the John Stevenson Co. of New York, and five by a local concern. With this equipment are used 12 converted trailers, the cars being all equipped with air brakes. The cars are painted in green and white.

The boiler room of the central station is equipped with the most modern of devices for the efficient production of steam. There are three Babcock & Wilcox water tube boilers, each capable of evaporating 6,000 lb. of water per hour and working under a pressure of 150 lb. The boilers are equipped with chain-grate stokers. The main flue passes through an economizer and the boilers are equipped with superheaters guaranteed to superheat the boiler steam to 200° F. Each boiler is supplied with an injector in case of damage to the feed pumps. Two feed pumps complete the boiler room equipment.

The engine room contains two, two-stage vertical Curtis turbines direct-connected to two 600-volt, 500-kw. generators. The air pump and centrifugal pump in connection with the turbine condensers are both motor driven. The circulating water is cooled in a cooling tower which has sufficient capacity to cool enough water for the whole plant. The auxiliary equipment is all motor driven and there is an air compressor in the basement which is also motor driven. A 20-kw. marine-set for lighting the station completes the auxiliary equipment. The plant is equipped with six boosters, five negative and one positive. The positive booster transmits the extra current to the lines farthest from the central station while the negatives are used to pull back the current through the overhead return, thus minimizing the risk of electrolysis. All cables supplied at this installation are lead covered. The main switchboard is of polished slate and has 31 panels.

The operation of the entire system is controlled by the Christchurch tramway board of which Mr. Wm. Reece is chairman, and Mr. G. G. Stead, deputy chairman. Mr. F. C. Chamberlain, who was chief engineer of construction, retains the position of chief engineer for the company. The cost of this system is estimated at about $50,000 per mile.

Dunedin.

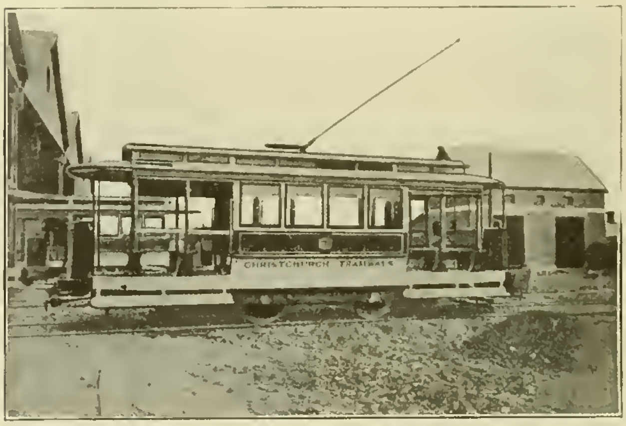
While Dunedin is the smallest in point of population of the four cities with which we are dealing, its tramway system compares favorably with those of the other three. The construction and equipment of the road are of a high order and the work of track laying was done in a comparatively short time. Work was commenced on Jan. 7, 1904, and on the 23d of that month over a mile and a half of city track had been laid. The total length of surface track when completed will be 20 miles of which 15½ miles are now open for traffic.

The track is laid with 93-lb. rails in lengths of 40 ft., which rest on Australian hard wood sleepers, 7 ft. 6 in. x 9 ft. 4½ in. The standard gage of 4 ft. 8½ in. is employed. Tie rods are placed about every eight feet. The track is ballasted, and top-dressed with asphalt. Where the ground is at all poor a good bed of concrete has been laid underneath. The Brown plastic rail bonds are used and each rail is cross-bonded by a No. 00 copper wire. Every 80 ft. of double track is also cross-bonded in the same manner between the inner rails.

The trolley wire, which is No. 00, is suspended from poles placed about 125 ft. apart. The center, side span and anchor poles are of the seamless tubular type. All feeders in the city are laid under ground. The cables are drawn into earthenware conduits through draw boxes spaced about 240 ft. apart. Where the feeder is tapped to the trolley wire the cable is brought up alongside the pole and into an iron box. In the suburbs the feeder wire is carried overhead. The conduits also carry the cables for the arc lamps, there being one lamp on every second pole through the main streets, controlled from the power house.

The rolling stock equipment consists of 34 cars built by the J. G. Brill Co., of Philadelphia. The box cars measure about 29 ft. over all and have a seating capacity for 30 passengers. The combination cars have an enclosed compartment in the center and two seats at either end in the open portion accommodating five passengers each. The open cars have seating accommodations for 50 passengers. The cars are all mounted on Brill 21-E trucks and the motor equipment of each consists of two 40-h. p. motors. Each car is provided with a hand-wheel, ratchet brake and a Westinghouse magnetic brake. There are six trailers which have been selected from the old horse cars and which have been renovated and mounted on Brill trucks. Nine extra cars of the open type have been ordered and are expected in time for the summer traffic. Destination boxes are fitted on the canopy at either end of the car, which are lighted at night and show the car's destination. An electric sprinkler holding 2,500 gallons of water, completes the rolling stock equipment. This sprinkler is provided with a patent track cleaner which is suspended from the frame of the truck between the wheels, and besides scraping the dirt from the grooves of the rails, is useful during the winter in cleaning snow and ice from the grooves.

The power house is of a temporary nature in view of the company's intention to ultimately install a water power equipment. The present installation consists of three Babcock & Wil-



SINGLE-TRUCK COMBINATION CAR AT CHRISTCHURCH.

cox water-tube boilers supplying steam to three vertical engines operated condensing and direct-connected to three Westinghouse generators which supply current at pressures of from 500 to 550 volts. There are 260 Tudor accumulator cells capable of a discharge of 350 amperes per hour. The use of these accumulators has resulted in a saving of 40 per cent in fuel and increases the load factor from 36 to 37 per cent. The switchboard is of Sicilian marble and contains 11 panels.

The car house is a brick structure 165 ft. square and is lighted by six sky lights set in a saw-toothed roof. In this house are 13 tracks and eight repair pits. A service line for compressed air is laid to provide for the quick blowing of dust from the motors and cars. Along the sides of the car house are the revenue office, the traffic staff's room, a machine shop, an armature room, stores and lavatories. The machine shop is equipped with an overhead crane, a 10-ton wheel press, a planing machine, lathes and several drilling machines.

The total number of passengers carried from the time of the opening of the line to the end of May, 1905, was 10,750,000, and this volume of traffic was handled with only two fatal accidents. During the greater part of the time only one-half of the system was running. In the 12 months ending May 31, 1905, over 7,000,000 passengers were carried, which would seem to indicate that the system has a good future before it. During the 12 months the total car mileage was 650,000. The appropriation set aside for the building of this system was $1,250,000.

New Limited Service in Indiana.

A new interurban service which has been installed by the Indiana Union Traction Co. and the Ft. Wayne & Wabash Valley Traction Co. between Indianapolis and Ft. Wayne, was inaugurated by a reception held at the Traction Terminal Building in Indianapolis on the afternoon of April 30th. Some two thousand invitations were issued and many traction officials from Ohio and Indiana were in attendance. Two of the new cars, the Kenilworth and Peru, were on exhibition at the Terminal station during the day. Light refreshments were served.

There will be four daily trains each way between Indianapolis and Ft. Wayne making the run in four hours and forty minutes. The fare on these trains will be $2.45 one way, and $4.40 for the round trip between Indianapolis and Ft. Wayne, if tickets are purchased at an office. One hundred and fifty pounds of baggage will be checked free on each full fare ticket.

The equipment for this service was illustrated and described in the "Street Railway Review" for April, 1906.

Discipline of Car Service Employes.*

BY J. G. HUNTOON.

In presenting a paper on the discipline of car service employes, we will necessarily confine ourselves to facts that have come under our own observation and to experiences in the supervision of car service men, extending over a period of years. By discipline is meant to the disciplinarian, not only the meting out of punishment to the guilty, but the training of the novitiate in the rules and regulations by which a body of men are kept in a state of efficiency and order. This is accomplished by a careful selection of men of good moral character backed up by the best of references.

The superintendent of employment should abstain as far as possible from appointing to the operating department a man whose chief recommendation is from some politician or office-holder who is endeavoring to pay his political debts by recommending to the consideration of the company one of his allies and a vote-getter, who in his opinion would be a good man for the company. We do not believe that applications of this character should be entirely ignored as good men are occasionally picked up in this way, and the question of policy applies, but we do insist on references other than those first presented. Applicants for a position should be closely questioned as to their past, their fitness for the position, their habits, etc. At least four letters of reference should be furnished by the applicant from good reputable men, former employers if possible.

Applicants for employment should be at least 21 years of age, of good health and not addicted to the use of intoxicating liquors to excess. In selecting trainmen, we prefer the married man as being more steady and less liable to leave on short notice. We do not, however, bar the single man, but of the two applicants, conditions being the same, we would select the married man. The successful applicant for employment is required to fill out an application giving his name in full, date of birth, name of wife, residence, name of father and mother if living, their residence, names and addresses of those dependent on him for support, the length of time and where he has attended school, previous occupation, cause of leaving last situation, whether he has had any previous street railway experience, in what capacity employed, when and where, the cause of his leaving, history of the past five years, giving each year in regular order down to date, closing with the following: "I certify that the foregoing statements are true, and hereby apply for a situation in the service of the Blank Ry., and if accepted, agree to maintain strict integrity of character, to abstain from the use of intoxicating liquor and tobacco while on duty, to refrain from the use of intoxicating liquors to excess while employed by the Blank Ry., to familiarize myself with the general and special rules and regulations of the company, to faithfully observe the same, to keep advised of such amendments to said rules and regulations as may hereafter be made and to perform all my duties to the best of my ability." This application should be filled out in the presence of, and witnessed by the head of the department in which the applicant is to be employed. The applicant is then passed on to the surgeon of the road, who examines him as to his physical qualifications. The examination should be thorough, not only as to the eyesight and hearing, but defects and deformities of the body and limbs should be noted.

Defective sight and hearing should be cause for rejection, as also hernia, and faulty heart action. Weight and height should also be considered: a conductor should weigh not less than 145 lb., and a motorman should weigh at least 160 lb. Their height should not be less than five feet and six inches.

The new men should be given a thorough course of instruction in the duties for which they have been selected. Particular attention should be paid to the instruction of the student, by placing him in charge of old and experienced men who will give him the necessary instructions and prepare him in a proper manner for the examination, which inevitably follows after the student is reported to the assistant superintendent as proficient.

This examination covers all the salient points in connection with the position for which he has been selected. After passing a satisfactory examination he is marked up on the extra list, and is then qualified to fill the different runs to which he is assigned, and is amenable to the merit system of discipline which was adopted Jan. 1, 1903, by the company with which I am connected.

This system was adopted on account of the unsatisfactory ways of the old methods of discipline which were by reprimand, layoff, and discharge. These had been in vogue for years. Often, under such methods, a layoff meant to the innocent family of the delinquent, hardship and actual suffering.

In the fall of 1902 our company became interested in the merit system of discipline as used at the time in Kansas City, Mo. Through the kindness of Mr. Satterlee, the general manager of the Metropolitan Street Railway Co., we were put in possession of the details of the system, and after a thorough discussion with the officers of the company, we decided to put the plan in operation on the first of January following. Previous to that date, however, a circular letter was sent out to all men in the train service of our company describing the merit system and announcing the date it would be introduced on our road.

With this letter sheets were sent out specifying the charges under which marks would be given. In brief, the system consists of a debit and credit account with each trainman, using the card index alphabetically arranged. When the demerits exceed the merit marks by 100, the party receiving them is subject to dismissal.

Every man started out with a clear record, but within a short time we noticed that a number of our men were getting demerit marks quite regularly. This continued until some had almost reached the limit, when again a change was noticed. The men who had previously been erratic in their conduct were noticed to be endeavoring to please, and were making every effort to win back that which they had lost. We have in mind a conductor on one of our lines who was constantly being reported for various infractions of our rules and had about reached the limit, when, to our surprise, he faced about and by careful work in looking after the interests of the company, won back all he had lost and today is considered one of our best men. Numerous instances could be cited where a man has started out wrong, but has been brought up with a sudden turn to realizing that if he continued along the same lines, he would eventually work himself out of a position.

Any act that is performed by our trainmen and reported to the office, that meets with our approval, whether reported by an inspector or a disinterested party, is noticed and trainmen reminded of the occurrence by a certificate of merit. We have found that by the judicious use of merit marks the trainmen are stimulated to greater exertion in pleasing the traveling public and guarding the interests of those who interest themselves in the trainmen's welfare. The man who is first on the scene in the case of a blockade, broken down car, or wire down, who exerts himself and endeavors to clear up the trouble should certainly be commended. The trainmen appreciate the fact that the company recognizes their worth, and mentally resolve that the company in the future will again be called upon to recognize their efficiency in other ways.

To teach employes to be guarded in their talk, their acts and their deportment on duty toward those with whom they come in contact is a problem nearer solved in the merit system than in any other way. The value of courteous, accommodating and careful trainmen to any street railway system is of such importance and so eagerly sought for that any method of discipline which will accomplish that end will be of great help in making the management of a street railway property a pleasure instead of a care and worry.

The demerit sheet for conductors consists of a list containing 55 demerit and 11 merit charges. For motormen 57 demerit charges are recorded and the same number of merit marks as on the conductors' list.

Operating under this system of discipline for a trifle over three years, we are of the opinion that it is far superior to the old method, and has a tendency to bring the management and trainmen close together and inspire them to greater diligence in the performance of their respective duties. The system, however, is incomplete, as some other and more substantial reward should be given to those, who in one year have to their credit 100 merit marks. A substantial reward that will not only encourage the man who receives it, but stimulate others to a higher standard.

*Read before the Iowa Street & Interurban Railway Association, Des Moines, April 19, 1906.

The general offices of the Indianapolis & Northwestern Traction Co. have been removed from Lebanon to Indianapolis, Ind.

THE
STREET RAILWAY
REVIEW
AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE
KENFIELD PUBLISHING CO.,
45-47 PLYMOUTH COURT, CHICAGO, ILL.
Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:
New York—39 Cortlandt St. London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:
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Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

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Entered at the Post Office at Chicago as Second Class Matter.

Vol. XVI MAY 15, 1906 No. 5

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ANNOUNCEMENT.

Beginning with the June number the "Street Railway Review" will be published under new auspices. The present owners have joined forces with the publishers of the "Railway Age," a weekly journal of the highest repute, which stands in the first rank of publications devoted to steam railway matters and the technical problems connected therewith. These two great journals will be owned and published by a new company, now in process of organization, to be known as "The Wilson Co.," with offices at No. 1660, Monadnock Block, Chicago. In this corporation the present publishers of the "Street Railway Review" will have a large interest and they bespeak for the new organization the same generous and hearty support that they have so long enjoyed at the hands of both their subscribers and advertisers. The present publishers wish to congratulate their patrons upon what the future has in store for them in their relations with the "Review." The resources in both a journalistic and a business way which the new publishers can command will enable them to put the "Review" on the highest plane of technical journalism.

FINANCE AND ACCOUNTS.

It is planned that in subsequent issues of the "Street Railway Review," Mr. Henry W. Brooks, Jr., will contribute a series of articles on the financial problems of electric railways. The series will include such subjects as electric railway mortgages; the financial aspect of consolidations; the operations of holding companies; the financial policies of individual roads, beginning with the outlining of the policy, its actual operations, and the final results as exhibited in subsequent balance sheets and income accounts. Other articles will treat more specifically of direct methods of strengthening the company's financial position, through sinking funds for bond issues, reserve funds for the maintenance of the property and to provide for accident losses.

To add to the general interest of these subjects, it is suggested that those identified with the administration of properties contribute, as fully as their time will permit, their own experiences along the lines just mentioned. If so desired, the information thus contributed will be used with reference to particular companies. By thus reciprocating, no doubt much information of value to all may be obtained.

AN IMPORTANT FARE DECISION.

The reasonableness of street railway fares ought not to be questioned by intelligent people living in the larger population centers of this country; but now and then a case comes up which cannot be settled except by a "full bench" decision. Several months ago the Boston & Northern Street Railway Co. increased the cash fare between the suburb of Melrose Highlands and Boston from 5 to 10 cents, at the same time placing on sale at certain places 10-trip tickets at 75 cents. The people of Melrose entered a strenuous protest before the Massachusetts Railroad Commission and that body made a thorough investigation of the situation. It is most gratifying to note that the board's published finding is entirely favorable to the company, with the minor point in exception that conductors should be charged with the duty of selling the reduced rate tickets in order to bring them within the more convenient reach of the public.

The commission states that under the prevailing conditions no company can carry passengers nine miles for five cents, and from the resultant earnings pay anything like a fair rate of interest upon the investment. It points out that in populous centers where a large and frequently changing patronage fills and refills the same car low fares yield a profit that cannot be realized upon lines which, for the most part, carry passengers long distances through smaller communities. The average cost of transporting passengers upon the ordinary interurban railway with its long distance riding, is necessarily greater than upon an urban line with its heavy traffic for short distances. When a railway is both urban and interurban in character, it is the great volume of constantly changing traffic within the city limits which makes possible the five-cent fare upon the long distance lines. The cost of roadbed and equipment, rate of wages, cost of heating and climatic conditions, all have an important bearing upon fares and these are high and severe in Massachusetts. The company's expectation that the riding in the Chelsea, Everett, Malden and Melrose districts would furnish a patronage similar to

that in a large municipality, has not been realized. The commission was unable to find a similar service elsewhere successfully performed for a five-cent fare, and concluded that any finding that the fares were excessive would be impossible. It is to be hoped that the citizens of the community affected by the finding will accept the final decision with appreciation of its fairness, and it is of suggestive interest to street railway managers that the points outlined above be kept in mind for use in times of ill-advised agitation of the fare question.

THE HEPBURN RAILWAY RATE BILL.

Believing that the Hepburn Railway Rate Bill, which is now under consideration by the United States Senate, may in a general way affect street railway organizations, the officers of the American Street & Interurban Railway Association have taken the matter under advisement for the benefit of the members. Several prominent electric railway legal specialists have expressed opinions that Section 1 of the Hepburn bill might be construed as applying to street surface railroads and while it is not thought that there is any intention of including street railways in the scope of the bill, it is yet feared that some occasion may arise when the doubtful wording of the bill may have a detrimental effect on the street railway companies. To bring this matter to the general attention of the various companies and to strive to prevent any such detrimental consequences, Secretary Swenson has mailed to each United States Senator a request that he favor the insertion in the bill of the following words: "but the provision of this act shall not apply to the operations of street railroads."

Letters have been mailed to member companies of the association calling attention to the doubtful wording of the bill referred to, and asking that in the interest of all member and non-member companies which might possibly be affected by the act, appeals be made to their representatives in the senate, urging the senators to use every endeavor to secure the adoption of the amendment which has been presented by Senator Platt of New York. In the handling of such matters as this, is one of the great values of the American Street & Interurban Railway Association shown. At such times it is very desirable to have concentrated action and an organization which can keep in touch with legislation with a view to upholding the rights of the electric railroads.

CAR VENTILATION.

One of the most difficult problems encountered in street railway operation is the ventilation of closed cars and there is good reason to welcome the approach of the open car season with relief, from the standpoint of both the public and the operating company. On steam roads the conditions are often worse than upon electric lines, considering the entire year, for it is usually impossible to secure a fresh air supply either in winter or summer without exposing the passengers to great annoyance from dirt and cinders. This advantage of electric interurban lines should never be lost sight of in stimulating competitive traffic.

It is unfortunate that at present there is so little progress toward adequately ventilated closed cars. The subject has been studied for years and a great many experiments have been made with ventilators of special design, but thus far little progress has been made. The fundamental difficulty is that too many people crowd into a limited space to make it possible to supply fresh air in a sufficient quantity and without creating heavy drafts. At times, relief can be had by opening the doors, but these are often blocked by passengers and the addition of the vestibule practically throttles the supply of fresh air down to a pretty small volume.

Partial relief is possible by way of the overhead ventilators, but the personal inclinations of the passengers vary so widely that the average conductor is literally between the devil and the deep sea in his efforts to adjust the fresh air supply discreetly. In a good many cases the company can only equip the car with ventilators and instruct its men to follow the wishes of the majority of the passengers. It is certainly a fact that without a strong public sentiment in favor of fresh air in street cars, the best design of ventilators will be ineffectual. Every year or so, attempts are made to legislate good air into cars, but this is a matter which laws are powerless to settle, for only an educated public can solve the problem with the means at hand.

A car body 25 ft. long, 8 ft. wide and 8 ft. high, contains only 1,600 cu. ft. of space, and when 50 or 60 people, with all sorts of ideas as to personal hygiene and cleanliness, press themselves into such a small room, the result is necessarily somewhat disagreeable from the standpoint of atmospheric purity. If the doors could be left open, together with the ventilators, the situation would improve somewhat, but as long as a howl of protest goes up when some liberal minded passenger opens a ventilator, little can be done, except to thoroughly air out the car at the end of the line.

In some cities, notably in Denver, the use of combination, open and closed cars, is practiced in winter as well as in summer, and there is no reason why a few open cars might not be run as an experiment on mild winter days even in less favored climates. In Denver, at an altitude of 5,200 ft., the open benches of the combination cars are popular even on cold days in January. Probably only a very small number of open cars could safely be operated in northern cities in the winter season, but it is safe to say that passengers accustomed to winter automobiling and sleighing would be attracted. The combination type of car, or even the semi-convertible type would probably fill the requirements better than the standard open car of the summer season.

THE LOCATION OF POLE STOPS.

The location of pole stops is generally looked upon as merely a minor detail of street railway work, and yet there is no doubt that the placing of the stopping point has an important bearing upon the facility with which traffic can be handled on congested routes. If the present number of stops per mile in city service could be reduced from 25 to 50 per cent, it is safe to say that the resulting improvement in schedule time would be greater than could be secured by the adoption of much more powerful equipment per ton of car weight, and the energy consumption per ton mile would also be lessened to a gratifying extent. Even in interurban service a reduction in the number of stops makes considerable difference in the power consumption. An extreme case may be cited in a test made last year upon the Boston & Worcester Street Ry. A car when run over the 31-mile line from Chestnut Hill to Lake Quinsigamond consumed 133.3 watt hours per ton mile in regular service westbound, and 108.6 watt hours, eastbound. The same car when operated over the road at night without stops, consumed only 112.1 watt hours per ton mile westbound, or 84 per cent of the usual service consumption, and eastbound, 94.8 watt hours, or 80 per cent of the in-put with stops.

Unfortunately, the public does not fully appreciate at the present time the gain in transit speed which a reduction in urban stops would bring about, and so it becomes doubly important to locate the marked poles only at points where the stoppage of cars will not block succeeding cars more than is absolutely necessary. On a single or double-track line without branches at side streets or other troublesome special track work the location of a pole stop will not make very much difference in the movement of traffic, provided the stop is set sufficiently far away from the street corner to avoid blocking the movement of vehicles in an intersecting direction. When the headway of cars is very short, say from 25 or 20 seconds downward, it might be a good plan to install two, three or four tagged stops at each regular street corner stopping place in the congested district, so that when the first car of a group comes to a standstill, the following cars can fill in the gap and come to rest without extra delays or stops on the wrong side of the intersecting street.

When two routes join by a curve from an intersecting street upon a main line the last stop upon each converging track should be made at the nearer corner, before the tracks have joined, whereas the stops upon the diverging lines should be made at the farther corners, after the tracks have separated, the idea in each case being to interfere as little as possible with the stopping of other cars. It is poor practice to install a pole stop at a street corner a hundred feet or so ahead of a turnout where waits are much more probable than on any other part of a line. Automatic track switches are a great help in expediting the movement of traffic, and if they are judiciously placed, it is a comparatively simple matter to locate pole stops so that the movement of the rolling stock will not be thoughtlessly impeded.

The gist of the whole question is to avoid every unnecessary stop and direct benefits are shown by making faster schedules

available with the same rolling stock equipment and the same power consumption as before.

As a means of illustrating the value of eliminating all unnecessary stops we refer to the description of time scedules used for the operation of city cars in Sheboygan, Wis., which description appeared in the "Street Railway Review" for March, 1906, page 162. The enterprising management of the Sheboygan property has introduced time schedules for the city cars and so perfected its operating methods that the cars are run very close to the schedules as distributed. As a means of assisting the motorman a mirror is mounted on a window post in front of the controller and a neat leather watch-pocket placed nearby. When the schedule was first introduced the motormen felt that it was a hardship to regulate their runs so that their cars passed the various stopping places at the published times, but now that they have become accustomed to this method of operation, the value of the schedule and the watch is appreciated.

The results of this city schedule operation have been very satisfactory, which is evidenced by the financial returns and the good feeling existing between the patrons and the operating company The same traffic is handled under faster schedule with one-third less cars than before, but to do this it is absolutely necessary that the operating cars be run according to the published schedules. There has been practically no change in the gross receipts. Less power is required because of the absence of reckless running and because the speed at which the cars operate is determined by schedule. Added to these desirable features is the remarkable gain of 70 per cent in revenue per car mile.

We feel that on many properties there is a lack of close attention to the details of city schedules. Oftentimes schedules are controlled by local conditions so that the equipment cannot be operated under economical conditions. However, the subject is an interesting one and marked improvements are being introduced from day to day.

ELECTRIC TRACTION LEGISLATION IN PENNSYLVANIA.

It is reported that the electric railway interests in the state of Pennsylvania will at the next meeting of the state legislature make a strong appeal for the passage of a bill which will allow the electric lines to handle freight. While now there are no laws of the state which prohibit the electric roads from doing a freight business, neither is there any provision that it may be done and so far but few of the larger roads have handled freight. Since the New Jersey legislature passed the act allowing the electric roads of that state to engage in carrying freight and express the Pennsylvania interests have become confident of the adoption of a similar bill in their state.

The Pennsylvania R. R., which is one of the strong factors in the politics of the state, has always openly opposed the handling of freight by the electric roads, but as there have recently been marked changes in the Pennsylvania political field it is not thought that the steam roads will be able to defeat the proposed measure. A large number of the tax payers of the state are convinced of the advantages that will accrue from electric freight handling systems and are lending influence which, it is expected, will greatly aid in the passage of the proposed act.

A REMARKABLE STATION DESIGN.

The new Atlantic Ave. station of the East Boston Tunnel, described at length in this issue, presents a remarkable solution of an engineering and transportation problem of no small interest. The opening of the station to traffic signalizes one more step in the unifying of the Boston transportation system which has been proceeding along broad lines and the result can be nothing but a lasting benefit to the communities affected. There is now available a rapid transit route from the heart of the financial district in Boston to the shipping district, with the added advantage of a physical connection between the tunnel station and the elevated station proper at the foot of State St. A welcome advance is had in the establishment of a faster, though somewhat roundabout, service between the banking district and the South Station than previously obtained on the surface, discounting waits for cars on the street. We do not believe that the extra toll charge of one cent for the use of the tunnel will discourage a wide use of the new facilities. Rapid transit is more a matter of time than of nickels and pennies in these busy days.

In the overcoming of physical difficulties the Boston Transit Commission has certainly done well at Atlantic Ave., for it is no mean task to erect a six or seven-story station, more than half of which is underground, in such a locality, at the very brink of the harbor. To unite the different sections into one harmonious whole; to equip it with apparatus absolutely unique in its technical features and yet thoroughly successful from the beginning of commercial service; to concentrate in one small space like this, every refinement for public safety known to engineering science and to co-operate with the lessee company in establishing a just and equitable, simple and frictionless layout and system for the collection of extra tolls, is work of a high order. The manufacturers of the elevators are certainly to be congratulated upon producing machines capable of running not only up and down but on curves—with true Boston geographical eccentricity—and lastly the public, which will use the station, and the engineering experts, who will study its operation, are fortunate indeed to have at their command so unusual and novel an adaptation of materials, ways and means to the successful solution of the problem of transferring large crowds between a double-track deep tunnel line, a double-track elevated line more than 70 ft. above and an intermediate surface level between the two.

FUEL ECONOMY AND BOILER DESIGN.

The paper read by Mr. Schumaker before the New England Street Railway Club, which is published in abstract in another column, emphasizes the importance of studying fuel economy and boiler design from a rather unusual standpoint. However widely opinions may differ as to the improvements in detail design which are likely to be incorporated in the boiler furnaces of the next few years, it is certain that gains in steam power plant economy are to be looked for at the boiler room end of the establishment if anywhere. There is no doubt that a more careful study of the efficiencies of the different methods of firing and closer attention to the intensity of the draft under different conditions of fire thickness, will in many cases result in a noticeable decrease in fuel bills.

The whole problem of firing is of vastly more importance than many managers realize at the present time. The difference between a good and a poor fireman often accounts for the entire discrepancy between so-called test records of coal consumption per kilowatt hour and the higher commercial figures which are on their faces evidence of inefficient service. We cannot agree with Mr. Schumaker that the mechanical stoker is bound for the scrap heap at no distant date; for in numerous installations this useful piece of apparatus has given and is giving satisfactory and uniform service. Doubtless an expert fireman who will stand up to the trying work of the boiler room with intelligent efficiency, week in and week out, is to be preferred to the stoker, but men of this calibre are difficult to secure at the prices commonly paid for the fire-room labor. A properly manipulated mechanical stoker goes a long way toward providing just the sort of even firing in small quantities which Mr. Schumaker desires, leaving for the boiler room force, the easier task of maintaining a fuel bed of uniform thickness and a draft suitable to the load requirements.

The New York State Board of Railroad Commissioners recently made public a compilation of statistics of the number of passengers carried and transferred on the street surface, elevated and subway railroad lines of New York City during 1905, as compared with 1904. The number of paid fares was 1,171,151,698, an increase of 93,439,451. The number transferred was 271,195,524, an increase of 7,816,362. The car mileage was 230,249,455, an increase of 28,664,543.

With the opening of the season for pleasure resort travel, the Brooklyn Rapid Transit Co. will have in service from 20 to 25 per cent more summer equipment in carrying capacity than was in service last summer. The most important item of the addition is 100 elevated cars seating 62 passengers each. On the surface lines, there will be 250 new cars seating 48 passengers each. All of these cars will have seats on either side of the central aisle and will be of wood and steel construction.

Alternating Current Track Circuits in the New York Subway.*

BY J. M. WALDRON, SIGNAL ENGINEER, INTERBOROUGH RAPID TRANSIT CO.

With the event of the high-speed electric roads, it was realized that they would have to be signaled, but as the rails were used for returns for the power current, it was manifestly impossible to use batteries for track circuits. It was therefore necessary to employ for such circuits, a fluid of such character to operate track relays as would not be hindered by the power current, and the relays themselves would not respond to the return current from the motors. Alternating current was found to fulfill these requirements, not alone when direct current is used for motive purposes, but as well when alternating current is used. In designing the instruments to be used in connection with the alternating track circuit, it was necessary to keep in mind that these instruments must respond quickly to the action of alternating current; but when the train shunts the track circuit the return power circuit, whether direct or alternating, must not cause the track relay to remain in the clear position.

In the New York subway, single-phase, 60-cycle current is used for the track circuits and for lighting the signals. This is supplied by turbo-generators in the main power house, and delivered to the sub-stations at a potential of 11,000 volts. The generators carry a constant load, and are entirely independent of the motive power circuit, thus the electro-motive force is constant. In the sub-station the alternating current is stepped down by oil-cooled transformers with a ratio of 20 to 1 to 550 volts, and delivered at this potential to the signal cables which extend through the subway from sub-station to sub-station. In the normal operation of the system, the transformers in all sub-stations are on the signal mains in multiple, and each station is provided with switchboards on which are mounted the necessary switches, circuit breakers, ammeters and synchroscopes, all of which are so connected that any sub-station can be cut off the line at any time, without interfering with the connection between adjacent sub-stations.

In case the 11,000-volt, 60-cycle cables leading from the main power house to the several sub-stations should break down, there is provided for reserve power in each sub-station a 25-kw. transformer, which is connected by an oil switch to the 25-cycle, 11,000-volt power circuit. This, at a potential of 550 volts can be thrown on to the signal mains by reversing a double-throw switch. The reversing of this switch cuts the 60-cycle transformer off, and the 25-cycle on the signal mains. The 25-cycle current is not intended for constant operation, as results from its use are not so satisfactory as from the 60-cycle current. This is on account of the considerable voltage fluctuations of the power current. The frequency being lower, the energy consumed when operating the signal system by it is increased about 66 per cent. In the course of a year, this would be no small item in dollars and cents.

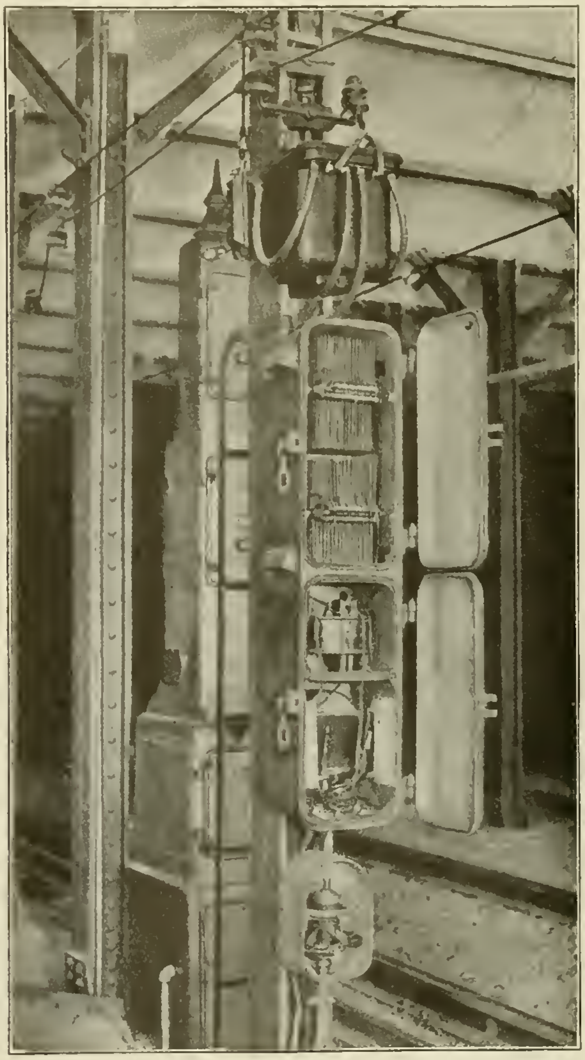
A transformer with two secondary coils is placed at the exit end of each block. The primary coil being connected across the alternating current mains, cut-outs and fuses are placed in each of the primary connections. One of the secondary coils supplies current to the rails for track circuits at a potential of about 10 volts. The other is for lighting the signals at 50 volts potential. In the circuit between the transformer and the block rail is a grid resistance of one ohm and a 50-ampere, 500-volt fuse.

The purpose of the resistance is to prevent a dead short circuit in the secondary coil of the transformer, when a train is in the block. At the signal end of the block, the alternating current passes from the rail through a 50-ampere fuse to a grid of one ohm resistance, then through a relay and impedence coil which are in multiple to the return rail; then through this rail back to the transformer or point of starting. The impedence coil has a winding of very low ohmic resistance around a laminated iron core, and is placed in the circuit in multiple with the alternating-current relay to prevent a harmful amount of direct current from passing through the relay.

The alternating-current relay consists of two pole pieces, which are made up by winding coils of wire around laminated iron cores between which an aluminum vane moves through a quadrant of a circle. This vane is supported on jeweled bearings and has mounted on its shaft, but insulated from it by lavite insulations, the necessary springs for controlling signals and stops. Attached to the end of these springs are small pieces of graphite which make contact with platinum on the tops of the stationary pedestals when the relay is energized; the relay is adjusted so it will pick up at three volts; that is, it will cause the springs to make contact when there is a potential difference of three volts, between the two rails of the track at the end of the block opposite the signal.

In the normal operation of the system, there is a difference of about six volts maintained between rails at the relay end of the block.

As the relay picks up at three volts, this gives a working margin of 100 per cent. The block lengths average about 820 ft. Their



SIGNAL APPARATUS, NEW YORK SUBWAY.

lengths are equal to the braking distance plus 50 per cent, when a train is making the greatest speed possible for it to make at that point. Grades are taken into consideration in making these calculations.

As all automatic signals must depend upon the track circuit for their operation, the efficiency of this determines the degree of success of the signaling system; therefore it is of prime importance that the track circuit should be the best obtainable.

A large portion of the subway signaling has now been in operation for 18 months, which is equivalent to 9 years' operation on a road having 304 trains per day.

The number of failures have been small, averaging about 17 per month. The number of alternating current relay failures has been one to about 75,000,000 movements. About 40 per cent of the total number of failures has been due to slivers from brake shoes bridging rail insulation joints in the vicinity of stations.

It is hard to realize what this record means, until one goes to a station in the subway during the busy time of day, and counts the

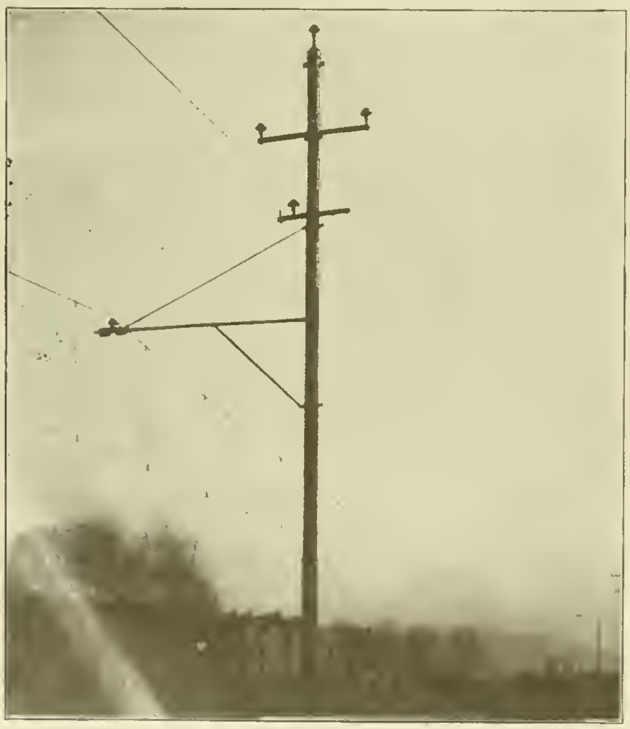
*Read before the Railway Signal Association, New York, May 8, 1906.

passing trains; at the end of 60 minutes it will be found that 122 trains or 786 cars, probably carrying 80,000 people, have passed by. If you make a journey over the road, you will find hundreds of signals and automatic stops all depending for their operation upon the track circuit, and all responding promptly to the action of the passing trains, and all performing their duty towards humanity, by protecting the train in advance from being run into by your train. On this record, the signals are to be considered the guardian angels of the subway. You will probably be interested in this precision and almost infallible operation, for the many hundred signals and hundreds of automatic stops you have passed, make 200,000 complete operations each 24 hours, and have for a whole month performed their duty with but 13 failures; all on the side of safety, or one detention to nearly one-half million movements.

A Recent Test of a New Form of Catenary Construction for the Electrical Equipment of the West Shore R. R.

When the project of electrically equipping the West Shore R. R. between Syracuse and Utica, N. Y., was under discussion, there was some question as to the best method to be employed for conducting the current. Both the third-rail and the overhead forms of construction have their advantages and were considered. At this time Mr. Elmer P. Morris, New York agent of the Electric Railway Equipment Co., of Cincinnati, agreed to erect about 1,000 ft. of an improved form of catenary construction which he had designed and on which tests could be made in an effort to determine the practicability of a system of this kind. This form of catenary construction is designed to be used on high-voltage systems of electric railways and Mr. Morris believed that its use in this instance would prove satisfactory.

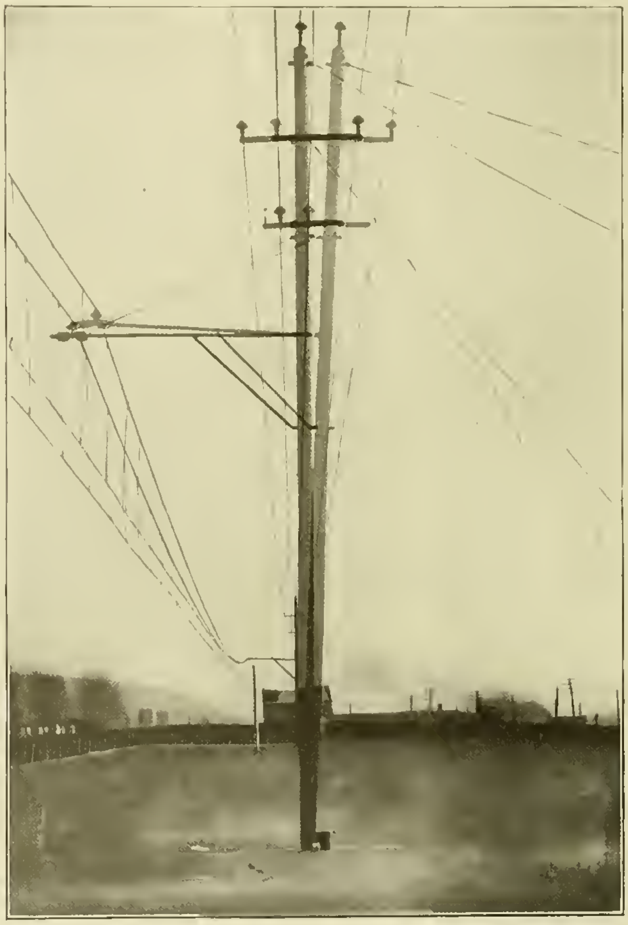
The test line was constructed at Reading, Pa., and the tests were made on April 21st. The line consisted of two sections, respectively 350 and 300 ft. in length, of catenary which were supported on tubular iron poles 48 ft. high. These poles, three in number, were 10 in. in diameter at the bottom, 8 in. at the top, and were set in



GENERAL VIEW OF CATENARY CONSTRUCTION.

concrete to a depth of 7½ ft. The poles were guyed with Miller anchors, manufactured by the Miller Anchor Co., Norwalk, O. These anchors stood the severe test loads in a very satisfactory manner. The tests were made on the middle pole, which was fitted up with the improved form of catenary support. This construction corresponded as nearly as possible to that to be erected for ordinary operating conditions.

The catenary cable was composed of ⅝-in. extra heavy Siemens steel strand wire covered with triple braid weather-proof insulation, giving a cable with a diameter of approximately ⅞ in. The cable was supported by a 2-in. tubular iron bracket 12 ft. long. The cable



TWO EXPOSURES ON ONE PLATE TAKEN TO SHOW THE NORMAL POSITION OF THE POLE AND ITS POSITION UNDER A 2,050-LB. STRESS.

had a sag of 5 ft. 5 in. From this cable was suspended a No. 0000 grooved trolley wire, the suspension being effected by means of spreaders of flat steel 1 x ⅛ in. in section, and of varying lengths. The spreaders were located 10 ft. apart. Forged mechanical ears and specially designed clamps were used at the ends of the spreaders.

The catenary insulator was fastened at the outer end of the bracket, which was strengthened by a ¾-in. tie rod and an under brace. This insulator was of the well known high-tension type, about 9 in. high, 4½ in. in diameter and tested for 80,000 volts pressure. Directly under this insulator and slipped around the bracket arm was a secondary grooved insulator designed to catch the messenger wire in case of the breaking of the main insulator.

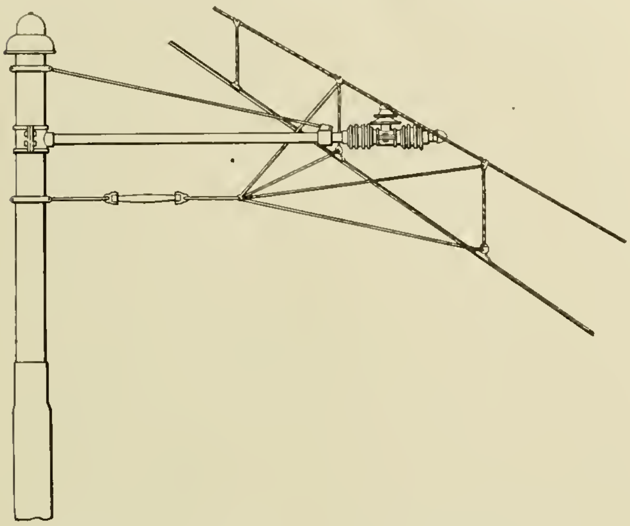
This method of construction is the special improved feature of which Mr. Morris has obtained very broad patents and which he claims makes line construction of this character safe and positive. The advantages of this form of construction over forms previously used is that at all time and irrespective of the condition of the main carrying insulator, no severe leakage can occur. The secondary insulator takes care of the lines if the main insulator is broken and prevents the messenger wire from coming in contact with the bracket arm. One of the features of this form of construction is that the messenger wire may be composed of copper cable and used as a feed wire. The accompanying views illustrate the method of construction of the system as tested.

The tests were made on the middle pole, which was side guyed, with the following results:

In the first test a 7-16-in. cable was led from the top of the

center pole to a point about 125 ft. back of the pole near the ground where a pull of 2,050 lb. was applied. This resulted in the pole being pulled considerably out of the perpendicular, due to the concrete foundation tipping, but the pole itself remained intact.

In the second test the pole was allowed to resume its normal position, leaving the original side guy tight. A downward load of 2,000 lb. was then placed upon the end of the bracket immediately under the catenary. This resulted in a permanent set in the bracket of about 3 in., the set appearing as a bow upward between the end of the tie rod and the pole.



DETAILS OF MORRIS SYSTEM OF CATENARY CONSTRUCTION.

In the third test the trolley was cut at approximately the middle of the 350-ft. section, allowing the ends to drop. The wire slackened a very little and the ends hung only a few inches below the original horizontal position of the point at which the cut was made.

In the fourth test both the trolley wire and the catenary itself were cut at the dead end stub and the whole catenary construction dropped to the ground. The effect of this test on the poles and their fittings was watched with interest by all present and the results were pronounced gratifying.

Representatives of the New York Central, the New York, New Haven & Hartford, Pennsylvania, New York & Queens County and the Mohawk Valley railroads and of the Reading United Traction Co., were present.

Effect of the San Francisco Disaster upon the Electric Railways.

Recent reports from San Francisco state that the damage by fire and earthquake to the electric railway properties of the United Railways of San Francisco was not as serious as might have been expected. Under the date of April 22nd, the following information is given:

The Bryant St. electric power station is in full operation. The North Beach power station is slightly damaged. The two cable power houses operating the Hays and McAllister St. lines were not burned. Only seven out of a total equipment of 455 electric cars, and 75 out of a total equipment of 423 cable cars were burned. Some shops and stores on hand were burned and damaged. The total general loss to all physical property of the company is estimated at $2,000,000. A large portion of this property, everything indeed except damage to track and overhead structure, is covered by insurance against loss by fire.

Operation on the Filmore and Sixteenth St. line was resumed April 21. This line is five miles long, and forms a belt beyond and around the portion of the city which has been burned. Market St., from Fifth St. to the Ferry, will be under trolley operation very soon, and the mayor has authorized the temporary operation of all cable lines by means of electric trolleys.

The directors of the company feel very much reassured. It is an interesting fact that the census of 1900, when San Francisco had a population of 342,000 people, showed a total population living within the recently burned area of 135,000 people. The growth of the city since 1900 has been estimated at 100,000 people, residing principally in that district of the city lying outside of the burned area.

Des Moines, Winterset & Creston Railway Co.

During the past year a substantial amount of preliminary work has successfully been carried on in central Iowa with a view to obtaining a firm basis for financing an electric road from Des Moines to Creston, Ia. The territory between these two cities at present is unoccupied except by a stub-end branch of the Chicago, Rock Island & Pacific Ry., which serves Winterset, a moderate sized city, at about the middle point of the proposed line. By steam railroad, the terminals are 91 miles apart but the electric railway mileage, as the right of way has been located, is but a fraction over 61 miles. There is said to be a tributary population of 162,340 adjacent to the route, which total includes the population of the northeastern terminus, Des Moines. As is well known, this portion of central Iowa is especially rich in agricultural products and the construction of an interurban electric line which can handle both passengers and freight, should be of great value to the rural population as well as a satisfactory investment.

The preliminary work for the entire route is now completed and the maps, profiles and engineering data well in hand. The private right of way will have its northern end at the terminus of a suburban line of the Des Moines City Railway Co. about four miles from the heart of the city. Traffic arrangements will be made so that the interurban cars will run to and from the center of the city of Des Moines. According to the estimates there will be required for the construction of the roadbed nine bridges of from 100 to 130-ft. spans, set on tubular piers; 4,700 lineal ft. of framed trestle; 2,800 lineal ft. of pile trestle; one 100-ft. reinforced concrete arch, and a number of concrete culverts which will require about 8,300 cu. yd. of concrete for their construction. The right of way crosses 46 public highways at grade and 15 highways by means of overhead bridges. There will be five grade crossings with steam railroads. The preliminary estimates call for the handling of 2,128,000 cu. yd. of earth work in the roadbed construction.

The power house for the operation of the entire road will be erected at a suitable location which has been chosen where the right of way crosses the Racoon River about 10 miles southwest of Des Moines. It is expected that there will first be installed two 1,000 kw. capacity 25-cycle, 3,300-volt alternators with the necessary steam generating and driving equipments. At the power house the generating pressure will be stepped up to 33,000 volts and transmitted along the right of way to three transformer sub-stations where it will again be stepped down to the single-phase trolley pressure of 3,300 volts. It is proposed to equip each of these transformer stations with two 250-kw. capacity transformers, one of which will be held in reserve. The single-phase transmitting lines will be made up of No. 2 bare copper and the working conductors will be No. 000 copper, supported by catenary construction.

It is proposed to purchase eight 52-ft. combination cars with four-motor, 75-h. p. equipments and suitable control for operating over either alternating or direct-current lines. There will also be needed two express cars and two electric locomotives. It is proposed to operate the passenger equipment speeds so that a car can make the round trip of 120 miles in five hours with a sufficient allowance of time for inspection at the terminals.

It is anticipated that the load factor on the power house may be improved by the sale of a considerable amount of power to small manufacturing establishments now in operation along the proposed route.

The preliminary work for this enterprise has been executed in a manner which should commend the careful attention of both constructors and those who furnish the promotion finances. It is interesting to note that when attempting to get a franchise in the town of Winterset, the promoters of the line being opposed by the town newspapers, published a very creditable newspaper of their own which was of much value in the franchise campaign.

The officers of the Des Moines, Winterset & Creston Electric Railway Co. are: W. D. Skinner, president; A. E. Park, general manager; S. D. Alexander, secretary and treasurer; E. J. Mackay, electrical engineer, and B. Schreiner, civil engineer.

Finance and Accounts.

CONDUCTED BY HENRY W. BROOKS, JR.

(Mr. Henry W Brooks, Jr., 15 Wall St., New York City, is a public accountant, auditor and specialist in financial and physical examinations of railway, public service and industrial properties.)

Notes on Financing Electric Railway Propositions.

It is now about the season of the year when construction work can be most advantageously begun and therefore at this time many new electric railway propositions are taken up. A few suggestions in reference to the successful financing of such propositions may therefore be opportune. Probably ninety-nine out of every hundred new propositions presented to New York bankers are rejected for one cause or another. Thus it might be well to investigate the reason for so many unsuccessful attempts before discussing new propositions.

Successful railway deals are made only when the details conform to certain financial principles. The success of an enterprise depends upon two very simple causes: first, there must be a feasible opportunity for a new road, and second, the method of conducting negotiations, should be correct.

Care in Preliminary Work.

Parties having in mind the construction of an electric road should first, before making any great expenditure of effort and money, determine the value of the proposed enterprise. If they are not practical and experienced railway men, they should, by all means, have a skillful and reputable engineer or railway expert make a preliminary examination, and report as to the feasibility of the project. If the report is favorable it will warrant a vigorous and confident prosecution of the enterprise. If the report is unfavorable, it should prevent the promoters from further expenses and disappointing efforts, provided that they abide by its decision. Unfortunately, too many optimistic, inexperienced promoters are prone to disregard conservative reports, because they practically reach a favorable decision prior to the rendering of the report.

A marked instance of the wisdom of careful consultation before embarking on a new venture can be cited as an example. Several years ago a few public spirited citizens of certain western towns, led by a somewhat visionary and wholly mercenary promoter, became very enthusiastic over the possibility of an electric road. No competent authority was consulted as to the traffic in sight or in prospect, the cost of constructing and equipping such a property ready for business, or the cost of operating the proposed type of road under a given traffic. One of the gentlemen, however, did talk with a capable and honorable local engineer, who in spite of the prospect of securing the engineering work, had the professional spirit to express an unfavorable opinion, but this was contemptuously ignored.

Several preliminary lines were run to determine the choice of route and some little expense entailed in securing franchises. An unsuccessful attempt was then made to secure the requisite additional construction capital. At this time the doubtfulness of the enterprise was made quite apparent. Already having sunk some little money in preliminary expenses, the promoters would not abandon the project and take their loss, but determined to build the road to get their money back. A final line was run, plans and specifications drawn, several miles graded and the principal promoters sent to New York to secure the balance of the construction funds. So step by step, they got in deeper and deeper until after some years of unsuccessful effort and alternate hope and discouragement, the whole undertaking finally was abandoned at a cost to each of the original backers (all men of moderate means) of about $16,000 for their experiences.

At the start, their misfortune might have been avoided by an authoritative and comparatively inexpensive preliminary report.

This instance is cited as typifying many similar experiences and to prevent like errors of judgment liable to occur to others. The necessity of having a good proposition, especially for an entirely new line, is obvious. Promoters should realize that their propositions for investment must be tested by the law of "The Survival of the Fittest."

While it may be granted that capital has heretofore been forthcoming for the construction of many unprofitable roads, this has, however, largely been due to clever promotion, the zeal of public spirited citizens, boomers of undeveloped tracts of land, and overconfident investors, and it is the best for all concerned to have absolutely nothing to do with any proposition not highly meritorious. To command attention a proposition should be far above the average in merit. The preliminary report warranting, engineering work having been accomplished and satisfactory franchises and right of way secured, then a few suggestions along the line of presenting the proposition to capitalists may be of value.

In endeavoring to enlist capital, the first thing to be secured is confidence, confidence in the safety and conservatism of the project, confidence in its permanent profitableness, and confidence in the personality of those associated with the enterprise.

In the ardent endeavor to interest capital, gross exaggeration is too often resorted to. Instead of awakening interest and inspiring confidence as intended, such tactics usually result in immediate loss of confidence and the termination of negotiations. Some electric railway propositions are even presented with all the glamour of a mining prospectus. Conservative bankers and railway financiers, those who really accomplish results, generally know very thoroughly what the various classes of electric railway properties are doing, and can do in the way of net earning capacities and what should be the proper capital requirements. Therefore, when promoters make exaggerated statements there immediately is raised in the banker's mind either of two fatal thoughts—the promoter's ignorance of the street railway business or his willful misrepresentation. Each accurate, conservative statement made, confirmed in the banker's mind by his own experience, tends to inspire his confidence.

Those interested in the promotion of new properties should bear in mind, that having secured favorable consideration, the proposition must finally undergo a searching and critical examination by railway experts, before the banker will undertake the financing of the company. Therefore it behooves the promoters to be technically correct in detailed statements. If there are any errors in judgment let these be on the side of conservatism, for this is the side of safety and results exceeding estimates are more gratifying than unfulfilled promises.

Correct Estimates of Traffic.

A few words in regard to errors in estimates may be useful. In general the estimates relating to the cost of construction and equipment are fairly reasonable, as construction estimates go, except that error in design frequently exists,—a lighter and cheaper type of construction is contemplated than present and future conditions of traffic, speed, equipment and future economical maintenance expenditures warrant.

Perhaps that feature most generally in error is the estimate of anticipated traffic. Granted that it is the most uncertain, least known and hardest ascertainable element in railway operations, there is no excuse for wilful exaggeration or careless approximating. Advantage is often taken of the uncertainty that surrounds probable traffic. The safety and profitableness of the whole enterprise depends upon the ability to secure, retain and increase a certain volume and density of traffic, consequently the services of the best traffic experts should be obtained.

Statements of total population are seldom exaggerated, probably because of the accessibility of recent census data. The error usually enters in the estimate of what is considered as tributary population and the average rides per inhabitant. The entire population of large terminal cities is somewhat erroneously included. Again, too great a distance from either side the line is considered as tributary territory, or again, due allowance is not made for certain competitive zones along the line. The estimate of average rides per inhabitant may be erroneously based on the data of roads operating in different sections of the country, where dissimilar social and in-

dustrial conditions of the inhabitants exist, or where there is a different distribution or grouping of traffic centers.

When by such means the passenger traffic cannot be made to cover operating expenses, bond interest of six per cent, dividends on watered stock capitalization and three per cent for surplus, the promoters sometime resort to fabulously productive freight and express earnings. The writer is a firm believer in the electric railway express business when conducted under the right conditions, yet experience so far does not show that $1,000 to $1,500 per mile can be earned on light traffic roads, as is sometimes shown in prospectuses. Certain interurban roads, which the writer is acquainted with, have had an express business established for at least three years, and the managements of these roads are very well satisfied with returns of from $500 to $900 per mile per annum.

Many suburban and interurban lines can often pick up quite a profitable express traffic with but small additional investment, usually only in car equipment and with but little increased operating expense. Several comparatively new interurban lines are earning from $200 to $400 per mile of single track and making a good profit. Estimates of express traffic almost wholly depend on purely local conditions, therefore no general average can be accepted as a basis of calculation.

Traffic estimates for proposed lines also often include a substantial amount for freight earnings. It is sometimes calculated that low grade freight may be handled to show a very material amount of net earnings and upon a basis of operating expense for such traffic which is not the result of practical experience. The parties who make such calculations seem to fail to understand the fundamental principles of electric railway power production and distribution,—that conditions do not permit of the cheapest handling of a regular freight traffic such as is conducted by steam roads. Whereas the steam road may make money by handling low grade freight on long hauls, yet the same conditions do not apply to the average electric road. The fact that freight traffic widely fluctuates in volume, daily and by season, and that extensive terminals and other special facilities are required, are conditions unfavorable to electric roads. Under certain local conditions, however, it may be correct to allow for reasonable earnings from handling freight, such for instance as that from mills, canning factories, etc., along the line—and switching, which traffic may usually be conducted by night or at other times of light load on the power station.

In the writer's experience, the cost of operation is frequently underestimated, although it is quite possible that it can be determined with a fair degree of accuracy. The estimates are often based on general averages of the operating ratios of other companies, and frequently upon some particular property which is skillfully managed and exceptionally well located; or upon operating figures of some neighboring roads with entirely dissimilar conditions; again, upon the reports of established companies not keeping up a proper standard of maintenance or making sufficient allowance for depreciation, their properties being comparatively new. A practical and experienced railway man can make, with a considerable degree of accuracy, estimates upon the cost of operating certain given properties with a certain volume of traffic, and service. Such estimates can then be checked with the ratios and costs for operating similar existing roads whose reports are available, being careful of course, to bear in mind all the points of comparison.

Financial Support.

Having shaped the proposition in an accurate, concise and complete manner, it will appeal to bond houses far more strongly for various reasons, if backed with good local support—by men prominent financially and municipally, who will give the enterprise their personal and financial backing to the extent of their abilities. The fact of strong local support insures favorable local sentiment which will tend to protect the road from unfair action on the part of local authorities and provide local support in the event of seeking future franchises or other accommodations.

As a rule the funds for constructing a road seldom come from the immediate locality, although local interests receive the benefit of the enterprise in the way of increase of population, appreciation of land values and new industries. It is therefore necessary to seek some outside financial aid and consequently the next and very important question arises as to whom to approach in order to secure the necessary funds. Many roads, and unquestionably the smaller ones, must secure their funds locally. Sometimes with a larger undertaking if some banker of high reputation and wide connection has been secured to lend his endorsement to the enterprise, it is possible to secure additional local investment. Therefore it is a very good policy to secure the financial sponsorship of such a banker or banking house, even if quite such good terms cannot be secured for the disposition of the bonds. While local investors may offer higher rates for a few broken lots of bonds, yet it must be remembered that the entire construction funds are required and that it may be cheaper in the end to take a lesser rate for placing the entire issue en block. The entire funds are then immediately available or on hand at such times as required for construction. This is a very material element in the successful financing of a property.

The art of financing lies chiefly in knowing who has the money and how to get it. It is almost useless to visit a large city for the purpose of securing the funds without first making the right preparations for the negotiations. Philadelphia, Boston and Cleveland are good financial centers for disposing of electric railway securities. Some Philadelphians have made large fortunes through street railway investments and therefore the bankers are quite familiar with this character of security. Many bankers have found safety of principal and liberal yield and therefore continue their investments along these lines. Speaking generally, New York City has not been a very good field for placing new electric railway securities. This is largely due to the bankers' preference for much larger security issues, such as those afforded by the larger steam railway and industrial companies. It is also due to the banks' discrimination in loans. The policy of the "downtown" banks is restricted largely to stock exchange collateral for the reason that they thus have marketable securities as collateral for their loans, which may then be liquidated at a moment's notice. Some trust companies are inclined to make temporary loans secured by the underwriting agreement or on the bond, or by both.

No general rules can be laid down as to conducting negotiations or making terms for the bonds. The officer of the company in charge of negotiations should bear in mind that the discount on new security issues depends upon the risk involved in the enterprise, the ease of the money market and stock market conditions. Bonds can be disposed of easier during a period of rising market than on a declining market or period of stringency conditions, and if unfavorable let the proposition lie dormant until the opportune time occurs.

To borrow money on a new proposition is very difficult because of the greater risk as compared with securing funds on a property having an established earning capacity of at least two or three years behind it. Therefore, it may eventually be more economical for a new company to first open negotiations with a connecting operating road to guarantee the proposed bond issue—in other words, to avail itself of the other company's credit. This will greatly facilitate the early negotiation of the desired loan.

While the foregoing remarks may appear rather severely critical of electric railway promotions, yet the intent has been to guard against errors of finance and to open the way to the successful negotiation of legitimate electric railway securities.

New York Subway Lease Controversy.

At the present time there is a controversy between Comptroller Metz and Mr. Belmont of the Interborough Co., in reference to payments under the lease. Under a provision of the lease a percentage on the net income, about five per cent on the cost of construction and equipment, is payable to the city. The comptroller has taken exception to the company's statement of the cost of construction and equipment and certain items included in the operating accounts.

The company includes $12,000,000 in its capitalization paid to John B. McDonald, August Belmont and others for the purchase of the lease. The cost of equipment, according to the company, was $23,000,000, but the comptroller estimates it as only $8,000,000. He also takes exception to charging the entire cost of the power plant to Contract 1, on the grounds that the capacity of the plant is excessive for that section and designed to furnish power for the elevated lines and future subways.

In regard to the operating accounts, the question has been raised as to the proportion of earnings and expenses, between Contract 1

and 2 (from the City Hall southward); also that part of the stated general expenses, such as directors' fees, $20,525; salaries of general officers and clerks, $332,787, part of which should be chargeable to the elevated lines. The $1,249,000 interest on the city's bonds, paid by the company, he refuses to include as a deduction prior to the statement of net income.

If Corporation Counsel Delaney sustains the position of Comptroller Metz, it is believed litigation will ensue which the company will resist.

Construction Cost Accounting.

As this is the time of the year for commencing construction work, it might be well to call attention to the details of construction accounting, and especially of cost data, and suggest this as an opportune time for preparing the necessary forms and instructions, if not already in use.

It has been the writer's experience in making examinations of the books and accounts of many electric railways, to find but little attention paid to the detail costs of construction. The "Construction Account" has always been a fertile field for analysis. But in tracing items to their sources, it is frequently found that original records have not been kept in a manner which renders them of great engineering value as a basis of cost data.

In more recent construction, however, greater attention has been paid to the accurate compilation of cost data. But this applies more particularly to extensions and reconstruction of existing lines, rather than entirely new roads.

There is no question as to the value of so accounting for construction expenditures as to determine detail costs. For instance, construction cost figures form a basis of comparison for future work done by the same road in the same city. They serve as a check on excessive subsequent costs and if the work is being done by the company, are apt to stimulate the engineer, superintendent or roadmaster toward building his section cheaper than his predecessor. A careful study of construction cost data almost invariably results in discovering waste which may be curtailed in future work, and such study is often the source from which new economical methods of conducting work are evolved.

In addition, accurate cost data form a value basis for making more exact estimates of the cost of a proposed reconstruction or extension. If compiled in a correct manner, changes in conditions, such for instance as increase in rates of wages, will not affect their value as a basis of calculation.

The lack of accurate construction estimates, has in several instances coming within the writer's observation, involved companies in more or less severe financial exigencies. This has mostly been in connection with new lines, but in one case an extension cost fully 25 per cent in excess of the original estimate and payment therefor coming at an inopportune time, the company had to add to an already unwieldy floating debt and eventually market its bonds at a fairly heavy discount—an additional cost. This was several years ago, and I believe the extension has not until recently earned a return on the total cost of construction.

Furthermore, when a road is known to possess accurate and complete cost data, it is possible to secure much closer bids from contractors, and the company is also in a position to better judge the advisability of doing the work with company forces or letting by contract.

The forms and methods required to properly classify construction costs may vary more or less with the character of the work, the company's general system of accounting and other conditions, but a few general ideas may be given. The first essential is absolute accuracy. Inaccurate data is worse than useless, being actually misleading. The frequent inaccuracy in detail construction cost data is found in the omission of certain elements of cost, such for instance as the following: all or part of construction plant and small tools, used on the particular job; supervision, all or a proportion of the salaries of superintendent, engineers, roadmaster, timekeeper, material man, clerks and others, devoting more or less time to construction matters; transportation of material over company's lines, and in some instances, the free transportation of labor on "employe's passes"; the actual cost of operation being chargeable to construction.

The writer has frequently found discrepancies between the gross amounts as shown in the construction account on the general books and the aggregate of detailed cost data compiled in the engineers' offices, the former being almost invariably largely in excess. This is due to the intentional inflation of the construction account for stock or bond capitalization purposes or to capitalize operating charges, or may be due to the poor accounting methods in vogue.

Roads contemplating construction work the coming season should take up the question of analysis of construction expenditures and introduce a proper accounting system.

The Sixth Annual Report of the United Railways Company of St. Louis.

The Board of Directors of the United Railways Co. of St. Louis has recently issued to the stockholders of the company its sixth annual report. Through the courtesy of President John I. Beggs, we are able to present herewith the substance of this very gratifying account of the year's work.

The report shows a gross income of $3,141,647 and a net income of $753,732 for the year ending Dec. 31, 1905. This is a decided increase over 1903, comparison being made with that year owing to the abnormal earnings of the company due to the World's Fair in 1904. The gross earnings and other income for 1905 shows an increase over those of 1903 of 16 per cent, or $1,164,160. The operating expenses and taxes have shown an increase of 8.5 per cent, or $383,102. For the year 1905 there is a surplus of $104,572 carried to profit and loss against a deficit in 1903 of $62,787. The percentage of passengers using transfers is steadily increasing, 41.48 per cent of all passengers carried in 1905 having used transfers, as compared with 40.25 per cent in 1903 and 36.76 per cent in 1901. There was expended during the year 1905, for betterments and additions to the property of the company a net amount of $335,495.

The company has heretofore labored under the disadvantage of having its wood-working repair shop located at a distance of about three miles from the machine and paint shops. Plans have therefore been perfected and contracts entered into for the construction of a commodious and comprehensive wood-working and paint shop adjacent to the machine shop, the cost of which will be about $160,000. It is expected that these shops will be ready for occupancy about the middle of the coming year. In order to provide for the increase of the company's business in the future, it has been deemed advisable to purchase a tract of land of about seven and a half acres which joins the company's shops and power house property at Park and Vandeventer Aves. This tract was acquired at a cost of over $80,000 and gives the company about 29.61 acres of land at this point.

It is the purpose of the present management, when the new shops are completed, to undertake the building of its own cars. The new shops have been designed with that end in view and it is the intention to turn out about two new cars per week to take care of the equipment as it wears out, and likewise to provide for the growth of the business.

No material change has taken place during the year in the location or number of miles of track owned by the company, but a much more substantial and durable character of track construction was put into effect. All the track is now being laid on a solid concrete base, the earth being excavated to a depth of six inches below the bottom of the ties in order to provide for a concrete base of portland cement of that depth upon which the ties are laid.

Announcement of the May Meeting of the Central Electric Railway Association.

The next regular meeting of the Central Electric Railway Association will be held at the Algonquin Hotel, Dayton, O., on Thursday, May 24th. As this will be the last meeting of the association until September, a full attendance is earnestly requested. At this meeting there will be a number of interesting papers and topics for discussion. Mr. E. L. Hamilton, Chicago, will read a paper on "Railway Y. M. C. A. Work," and there will be a paper entitled "The Best Methods for Stimulating Summer Riding," by J. W. Brown, superintendent of transportation, West Penn Railways Co. There will also be a paper entitled "Fire Insurance at Cost," by Henry N. Staats, manager of the Associated Railway & Light Cos., and "Axles for Interurban Cars" will be discussed by Mr. Replogle of the Cambria Steel Co. Open discussions will be invited on a number of topics which will be of much interest to all

The Backstrom-Smith Steam Turbine.

The recent successful test of the Backstrom-Smith turbine in the Oneida St. plant of The Milwaukee Electric Railway & Light Co., may be taken as marking an important step in turbo-engineering. The important feature of this turbine is that it operates under constant stage pressures in varying quantities to suit varying loads from the maximum down to the minimum, and that it is instantly available for either condensing or non-condensing work, the output of the machine remaining unchanged. Another feature of this machine is the simplicity of its mechanism and the ingenious methods of construction which make it at once a commercial proposition that can compete with other forms of prime-movers in both economy, first cost and maintenance expense.

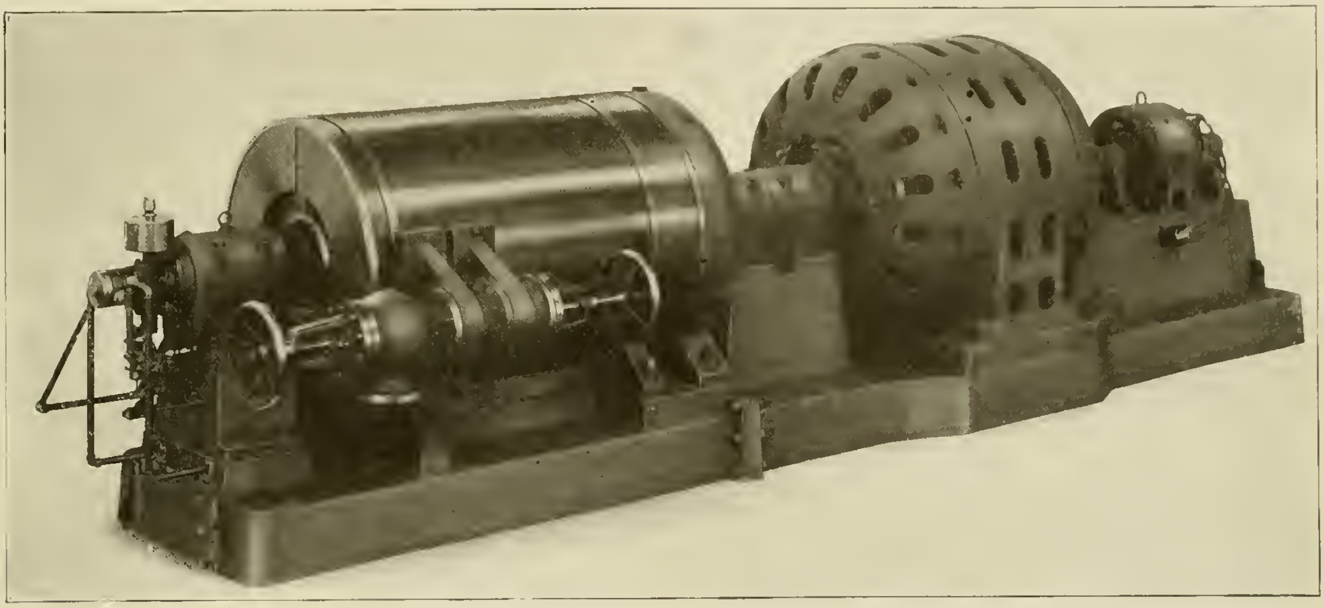
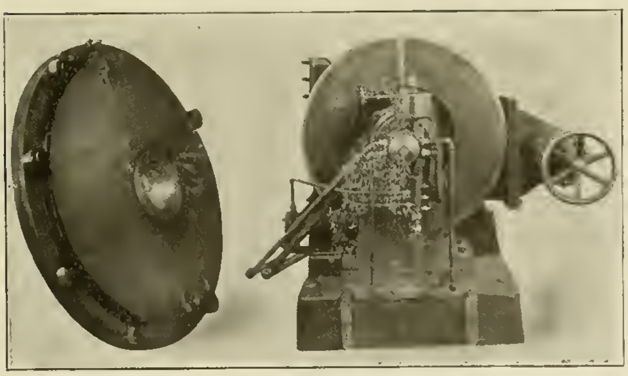


FIG. 1. BACKSTROM-SMITH STEAM TURBINE WITH GENERATOR.

In a general way, this turbine may be described as multi-cellular and of the inflow type. The general form is shown in Fig. 1. Special means are provided for direct coupling to the alternator and exciter.

In order to do for the turbine what the corliss valve did for the reciprocating engine, this turbine, it is claimed, for the first time in the art, is provided with means for meeting the requirements of changing loads without throttling, making it nearly as economical for light loads as for the heaviest. The mechanism by which this is accomplished, is unique. Flexible steel bands are secured to the periphery of the nozzle sextions and to spools or rollers, shown in Fig. 2, mounted on a collar or ring which has a limited rotary travel around the housing, inside of which each turbine wheel revolves. A movement of this collar winds or unwinds the steel tape on each of the spools, uncovering or covering the series of nozzles or ports which admit steam to the active buckets of the turbine wheels. This winding or unwinding of the steel tape is done automatically, the device being so arranged that the flow of steam is always in proportion to the load. Steam enters the different stages at a pre-determined and constant pressure, but in varying quantities, depending upon the number of nozzles covered or uncovered by the steel tapes. This automatic regulation is accomplished by means of a shaft running the full length of the turbine in the bottom of the housings. At proper intervals on this shaft are keyed pinions which engage coresponding teeth cut in the ring or collar on which the several tape rollers are mounted. These rollers engage with short racks secured to the nozzle ring or housing. The minutest motion of the shaft results in winding or unwinding the tape on the rollers, thus closing or opening more or less of the nozzles. The motions of the shaft operating this ingenious cut-off mechanism are controlled by the governor shown at the left in Figs. 1 and 3. The governor controls a flow of oil under constant pressure, which by means of a pressure cylinder and a rack and pinion, rotates the shaft in one or the other direction.



FIGS. 2 AND 3. STEAM CONTROLLING MECHANISM AND GOVERNOR END OF TURBINE.

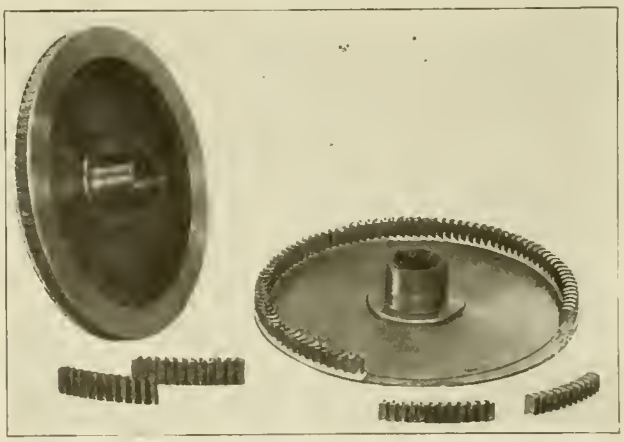


FIG. 4. TURBINE RUNNERS.

The governor is dependent upon the proper action of the lubricating mechanism, as any accident to the latter results in an automatic stopping of the turbine, thus insuring the machine against self-destruction.

In addition to this governor with its two important functions, a safety device is provided in the shape of a governor which controls a butterfly valve. This valve closes automatically when the turbine

speed reaches five per cent above the normal and is otherwise inoperative.

In the size turbine illustrated (400 kw.), which was recently tested, as earlier mentioned, there are 10 turbine wheels or runners, the general form of which is shown in the vertical figure in Fig. 4. This figure illustrates a runner in one of the earlier stages, the bucket face of each successive wheel being wider. All the runners have an equal number of buckets of a uniform cross-section. This feature applies as well to the nozzles.

It is the claim of the inventor that superheated steam is not as essential to the economical operation of the Backstrom-Smith turbine as is the case in others. In the first place it is held that there is a minimum of condensation, because of the constant pressure and temperature maintained at all loads in all the stages of the turbine. The next contention is that all the water contained in the steam is separated from it and that this water which is shifted or drained into the succeeding stage by automatic means, is at once in part, if not wholly, re-evaporated, thus becoming useful energy. Again, by using high steam velocities, claim is made that surplus velocity appears in the form of superheat, which greatly reduces internal condensation and skin friction. As an illustration, steam at 150 lb. gage pressure reaches the first stage of the turbine at a temperature of 366° F. Any water contained in this steam, having naturally the same temperature, is separated from it, falling to the bottom of the stage-chamber, from which it passes through an automatic device into the second stage, where the pressure is, say, 91 lb. and the temperature 332° F. An instantaneous evaporation naturally follows from these differences in pressures and temperatures.

A Backstrom-Smith turbine built and installed for use in connection with a condenser is arranged so that it may be quickly converted into an economical non-condensing type, should the condensing apparatus get out of order or become inoperative. This is done by providing an auxiliary exhaust at a point favorable for exhaust to atmosphere. This early exhaust relieves the turbine from a certain amount of back pressure which would arise from forcing a large volume of already fully expanded steam through a number of useless and idle turbine wheels, causing a considerably reduced efficiency and other unfavorable effects. A permanent provision for operation under overload with or without condenser is provided through the valve shown at the right in Fig. 1. This valve may be operated by hand or it may be under direct control of the governor.

No effort is being spared to place this turbine on the highest commercial basis. The buckets to each of the wheels are cast in sections and all machining of these difficult and important parts is dispensed with. By the liberal use of polished, non-corrosive nickel steel, the builders have succeeded in producing, in a very practical way, an inexpensive and very effective casing for runner-buckets as well as linings for nozzle openings, cast into attachable sections. Assembling is facilitated by the fact that the turbine is made in separate, independent, standardized sections, easily bolted to each other in erecting. The usual practice of making parts in halves is not resorted to, and yet any part is readily accessible and can be easily replaced when repairs are necessary.

The builders are now prepared to take orders for short delivery for units of not less than 400 kw. nor more than 2,500 kw. A new type of alternator recently perfected by the Western Electric Co., will be used in connection with the turbine.

Meeting of the American Street Railway Manufacturers Association.

A meeting of the American Street Railway Manufacturers' Association was held at the New Grand Hotel, New York City, Friday afternoon, April 27th, at 4 p. m. An executive meeting was called at 3 p. m. The new constitution and by-laws of the association were approved.

Mr. McGraw, chairman of the committee appointed to act with the committee of the American Street & Interurban Railway Association, reported that after carefully going over the matter of selecting a suitable location for the next annual convention, Columbus, O., had been chosen because of its central location in the interurban railway district of the middle West, and because of the city's excellent facilities for taking care of such a meeting.

President Ely was called upon to address the meeting. He confirmed the various reasons given for selecting Columbus as the convention city and stated that from the enthusiasm shown by the business men of Columbus he was satisfied they will do all they can to make the convention a success.

A committee consisting of Messrs. Ellicott, King, McGraw, Pierce, Randall and Secretary Keegan was selected to visit Columbus and make preliminary arrangements for the convention.

Officers for the ensuing year were elected as follows: President, James H. McGraw; vice-president, Charles C. Pierce; treasurer, Edw. H. Baker; George Keegan was reappointed secretary of the association at a salary of $1,000 a year.

Annual Report of the Chicago & Milwaukee Electric Railway Co.

The annual report of the Chicago & Milwaukee Electric Railroad Co. for the year ending Dec. 31, 1905, shows a substantial gain in earnings. Extensive improvements were made during the year just past. There have been completed a fine modern office building at Highwood, costing approximately $40,000, and also 12 waiting stations. The company has reconstructed its road from Lake Bluff to North Chicago, on entirely private right of way and has made extensive improvements along the entire line.

As was noted in the "Street Railway Review" for December, 1905, the Wisconsin Division, as far as Kenosha, was placed in operation on Dec. 2, 1905. The earnings from this extension have been very gratifying. Practically all of the right of way to Racine has been acquired. Most of the concrete arches have been built and considerable grading has been done. It is expected to have the road in operation to Racine by the middle of July of this year and to Milwaukee, by the end of this year.

The construction of the new road from Lake Bluff to Kenosha is entirely on private right of way, not less than 100 ft. wide through the cities, as well as through the country between cities and towns. The company holds pepetual and unlimited franchises in each of the cities and towns through which the road is built. All double-track construction will be built with a maximum of one degree of curvature and in practically an air line. All abutments are of concrete with heavy steel bridges having a carrying capacity of 100,000 lb. cars and built for four-track construction. The track is laid with 80-lb. rail, white oak ties, and "continuous" joints. Two tracks will be used for local service and two for fast express service.

On Feb. 26, 1906, the Chicago & Milwaukee Electric Railroad Co. acquired a valuable franchise from the city of Milwaukee, which gives the company a straight entrance into the business center of that city.

The following is a statement of the income account of the company for the year 1905:

Earnings.		
Passenger	$344,960.53	
Freight	232,538.76	
Express	6,877.06	
Miscellaneous	10,498.29	$594,874.64
Operating Expenses, Etc.		
Trainmen	$ 54,654.46	
Power and Sub-station men	23,932.40	
Maintenance	43,274.78	
Fuel	36,911.32	
Freight operating expenses	35,352.58	
General expenses	50,426.30	$244,551.84
Net earnings		$350,322.80
Other income		14,462.50
Total net income for the year		$364,785.30
Interest on bonds	$250,000.00	
Taxes and insurance	13,878.84	$263,878.84
Net surplus for year 1905		$100,906.46
Surplus from 1903-4	$225,426.99	
Naval Station site fund	25,000.00	200,426.99
Net surplus, Dec. 31, 1905		$301,333.45

The Annual Report of the Massachusetts Board of Railroad Commissioners.

The 37th annual report of the Board of Railroad Commissioners of Massachusetts has recently been issued. The report contains much data regarding street railway companies, an abstract of which is herewith presented.

Annual returns for the year ending Sept. 30, 1905, have been received from 98 street railway companies. Returns of the operations of two roads operating in New Hampshire and one operating in Connecticut were also received. In addition, returns were received from the receivers of the Hampshire & Worcester, the Middleborough, Wareham & Buzzards Bay and the Bristol County, for the period during which the railways were operated by receivers.

Gross Assets, September 30, 1904 and 1905.

ASSETS	1904.	1905.	Increase.
Construction,	$69,581,366	$73,180,888	$3,599,522
Equipment,	26,201,913	26,545,308	343,395
Land and buildings,	32,296,112	33,359,369	1,063,257
Other permanent property,	1,446,944	1,612,627	165,683
Cash and current assets,	6,554,738	12,315,705	5,760,967
Miscellaneous assets,	4,762,667	4,728,336	34,331*
Gross assets,	$140,843,740	$151,742,233	$10,898,493

* Decrease.

During the year, five new companies were organized under the general law and added to the list and four new companies which were purchasers of railways sold at receivers' sales were also organized under the general law. Thirteen companies have been dropped from the list, having been consolidated, or for other reasons. By reason of consolidation, there were at the end of the fiscal year 92 existing companies. Of this number, 63 operated their railways; two railways were operated by receivers; 18 were operated by lease or contract by other companies, in three instances foreign companies; three were being constructed; one was not in operation; and five companies had organized and paid in a portion of their capital stock, but had not commenced the construction of their railways.

Capital Stock, Net Income and Dividends, 1896–1905.

YEARS.	Capital Stock.	Net Divisible Income.	Dividends Declared.	Percentage on Total Capital Stock.
1896,	$30,727,818	$2,280,776	$1,802,847	5.87
1897,	32,670,273	2,593,147	1,965,243	6.02
1898,	38,933,917	2,534,002	2,076,233	5.33
1899,	41,380,143	2,502,942	2,318,398	5.60
1900,	48,971,168	3,037,502	2,409,874	4.92
1901,	54,069,933	3,398,183	3,417,117	6.32
1902,	60,036,328	3,388,851	3,138,711	5.23
1903,	68,404,480	3,602,917	3,586,248	5.24
1904,	68,542,038	2,998,114	3,214,496	4.69
1905,	70,326,985	3,556,690	3,174,505	4.51

During the last year there have been added to the mileage of the Massachusetts companies 27.98 miles of street railway lines and 22.602 miles of second track, making 50.582 miles of additional main track. There have also been added 1.814 miles of side track, making a total addition of 52.396 miles of track reckoned as single track. The Massachusetts companies now own 2,219.792 miles of street railway line, 405.442 miles of second main track, and 151.474 miles of side track, making a total length of track owned 2,776.708 miles. This statement excludes the track in the subways. All the street railway mileage owned is located in Massachusetts with the exception of 19.526 miles of track located in Rhode Island. All the track owned is surface street railway track with the exception of 6.644 miles of elevated line and 6.468 miles of elevated track. Of the sidings, all are surface track with the exception of 2.903 miles of elevated track. All of the elevated track is confined to Boston. There are now 52.933 miles of main and second track operated outside of the state. The total miles of main track operated is 2,668.501, which is an increase of 14.022 miles over the previous year.

The gross assets of the companies on Sept. 30, 1905, were $151,742,232.71, and the gross liabilities at the same date, including capital stock, were $145,603,242.30. There has been in the past year an increase in the gross assets of $10,898,493 and an increase in the gross liabilities of $9,553,756, thus increasing the aggregate surplus of the companies by the amount of $1,344,737. The aggregate funded debt of the companies on Sept. 30, 1905, was $55,780,500, an increase of $9,105,616 over the preceding year.

Cost and Capital Investment per Mile of Main Track, 1896–1905.

YEARS.	Construction.	Equipment.	Other Permanent Property.[1]	Total Cost per Mile.	Capital Investment per Mile.[2]
1896,	$23,396	$9,805	$12,840	$46,041	$46,373
1897,	22,755	9,374	12,329	44,458	44,683
1898,	22,537	8,957	11,735	43,229	44,958
1899,	22,863	8,518	11,598	42,979	45,040
1900,	23,443	8,510	11,684	43,637	44,273
1901,	23,953	8,678	11,666	44,297	45,757
1902,	24,495	9,026	11,889	45,410	46,261
1903,	26,015	9,994	12,546	48,555	48,621
1904,	27,025	10,177	13,106	50,308	50,295
1905,	27,876	10,112	13,321	51,309	50,772

[1] Chiefly lands, buildings and power plants. [2] Outstanding capital stock and net debt.

The aggregate capital stock of the 92 companies on Sept. 30, 1905, was $70,326,984.78, a net increase of $1,784,947.28 over the preceding year. The total amount of dividends declared during the year was $3,174,505.24, a decrease of $39,991 from the preceding year. Thirty-five out of the 98 companies paid dividends ranging from 2 to 10 per cent and 63 companies declared or paid no dividends.

The average cost of the street railways of the state per mile of main track (including the cost but not the length of side track), as it stood on the books of the companies Sept. 30, 1905, was $27,875.95 for construction; $10,111.59 for equipment, and $13,321.48 for lands, buildings (including power plants), and other permanent property, making a total average cost of $51,309.02 per mile of main track.

Volume of Traffic for Ten Years, 1896–1905.

YEARS.	Total Passengers Carried.	Average Number per Mile of Main Track Operated.	Total Car Miles Run.
1896,	292,358,943	226,452	53,613,685
1897,	308,684,224	212,403	61,577,917
1898,	330,889,629	207,982	68,206,418
1899,	356,724,213	205,098	73,367,235
1900,	395,027,198	200,262	81,750,768
1901,	433,526,935	195,683	93,005,225
1902,	465,474,382	188,787	100,280,687
1903,	504,662,243	192,548	107,506,812
1904,	520,056,511	195,917	107,897,456
1905,	532,731,017	199,637	109,258,739

The total income of the companies from all sources, for the year ending Sept. 30, 1905, was $28,638,251.58, and the total expenditures (including dividends) were $28,256,066.46, making a net surplus of $382,185.12 to be added to the surplus of previous years. The total number of passengers carried during the last year on the railways of the 98 companies making reports to the board, was 532,731,017, an increase of 12,674,506 passengers over the previous year. The total amount of car mileage was 109,358,739, an increase of 1,361,283 miles over the previous year.

The whole number of persons injured in connection with street railway operation, as reported by the companies for the year ending Sept. 30, 1905, was 5,766, of whom 85 received fatal injuries and

5,681 injuries not fatal. The number of passengers injured was 3,977, of which 18 were injured fatally. The total number of injuries to employes was 217, of which 13 were fatal. The number of injuries to travelers and others on the street was 1,572, of which 54 were fatal. These figures include a large number of injuries of a trivial character.

The engineer of bridges reports that there are now 423 bridges which have been either built or strengthened by a street railway company. The 423 bridges referred to may be classified as follows: 44 pile bridges; 31 wooden trestles; 11 steel trestles; 39 wooden stringers; 4 braced or trussed wooden stringers; 3 wooden or combination trusses; 6 stone, brick, or concrete arches; 112 I-beam bridges; 90 plate girder bridges; 72 steel riveted truss spans; 7 steel pin-connected truss spans; 3 wooden movable bridges and 1 steel movable bridge. This is an increase of 18 over the number reported last year.

Percentage of Operating Expenses to Gross Earnings, 1896–1905.

YEARS	Gross Earnings from Operation.	Operating Expenses.	Percentage of Expenses to Earnings.	Net Earnings
1896,	$14,844,262	$10,563,371	71.16	$4,280,891
1897,	15,815,267	10,904,040	68.95	4,911,227
1898.	16,915,405	11,672,731	69.01	5,242,674
1899,	18,151,550	12,378,488	68.20	5,773,062
1900,	19,999,640	13,159,947	65.80	6,839,693
1901,	21,766,340	14,565,141	66.92	7,201,199
1902,	23,486,474	15,912,852	67.75	7,573,622
1903,	25,540,811	17,519,367	68.59	8,021,444
1904,	26,207,247	18,397,291	70.20	7,809,956
1905,	27,041,291	18,269,259	67.56	8,772,032

The report states that the commendable features in the management of the Boston Elevated Railway Co. would undoubtedly receive favorable criticism that is now withheld were it not for the crowding of stations and of cars at certain hours in the morning and evening. While the company during the year has brought into use more cars and trains, added to its force of employes, made changes at stations and introduced the change to side doors at the ends of the cars, the public must await the completion of the Washington St. subway, which is now being constructed in a most commendable manner; the building of the extension to Forest Hills, with accompanying changes in stations; and the abolition of the Dudley St. railroad crossing, for which the board has recently approved plans, before the running of longer trains and a greater freedom in the distribution of traffic will effectually relieve the congestion.

Gross and Net Earnings from Operation per Mile of Main Track Owned, 1896–1905.

YEARS.	Average per Mile of Track Owned. Gross Earnings.	Expenses of Operation.	Net Earnings.
1896,	$11,627	$8,274	$3,353
1897,	11,187	7,713	3,474
1898,	10,998	7,589	3,409
1899,	10,459	7,132	3,327
1900,	10,452	6,878	3,574
1901,	9,998	6,690	3,308
1902,	9,609	6,510	3,099
1903,	10,124	6,944	3,180
1904,	10,178	7,145	3,033
1905,	10,300	6,959	3,341

During the severe weather of last winter the running of trains through the south terminal yard was on several occasions interrupted. Among the devices suggested for the prevention of delay occasioned by storms and severe weather were the roofing over of the yard, the installation of oil or electric heating plants, or the construction of a system of snow pits beneath the track. The commissioners however consider that the end would not justify the means and are satisfied that the present practice of employing men to keep the tracks and switches free from snow and ice is altogether the best and the simplest one.

The practice of locking from the outside the door leading from the body into the front vestibule of street cars was recently criticised in an order of the board in which it was held that companies in permitting this were adding a new peril to travel in case of a mishap to the motorman in which event, it might be of considerable importance to reach the front vestibule from within the car. To meet the objection to the present method of locking doors, it is proposed to adopt some device which will enable the conductor as well as the motorman to open them.

Gross and Net Earnings from Operation per Car Mile Run and per Passenger Carried, 1896–1905.

YEARS.	Average per Car Mile. Gross Earnings.	Expenses of Operation.	Net Earnings.	Average per Passenger. Gross Earnings.	Expenses of Operation.	Net Earnings.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
1896,	27.69	19.70	7.99	5.08	3.61	1.47
1897,	25.68	17.71	7.97	5.12	3.53	1.59
1898,	24.80	17.11	7.69	5.11	3.52	1.59
1899,	24.74	16.87	7.87	5.09	3.47	1.62
1900,	24.46	16.10	8.36	5.06	3.33	1.73
1901,	23.40	15.66	7.74	5.02	3.36	1.66
1902,	23.42	15.87	7.55	5.05	3.42	1.63
1903,	23.76	16.30	7.46	5.06	3.47	1.59
1904,	24.29	17.05	7.24	5.04	3.54	1.50
1905,	24.75	16.72	8.03	5.08	3.43	1.65

Regarding block signals the commissioners state that the day for discussion as to whether signals founded upon a division of railroads into blocks are a desirable safeguard, is passed, experiment having conclusively proved their value. The extent to which automatic action is a feature of these plants varies greatly. This is well illustrated in two systems which, submitted to a thorough test of years, have each shown very satisfactory results, one upon the Pennsylvania R. R. between Jersey City and Philadelphia, where an automatic electric plant has been in use, the other upon the Hudson River railroad between New York and Albany, where a system under elaborate manual control has been employed.

Block signals give an engineer more definite knowledge of conditions immediately ahead of him, and, in limiting the field of his responsibility, decrease the chances of accident. While failure to observe these signals is always possible, the likelihood of collision is undoubtedly lessened by their use. With the development of mechanical and electrical appliances, they can readily be operated in such manner as not to seriously interfere with the conduct of the busiest traffic.

Fixed signals of one kind and another have long been in use at places upon many railroads. As improvements have been made, the older types have given place to newer ones, and changes are now going on. The block signal has been introduced to a varying but insufficient extent upon these railroads. The commissioners believe that the system should be generally installed where trains follow each other in quick succession or meet each other at frequent intervals. This suggestion applies as well to street railways where cars are run at high speeds.

The Allis-Chalmers Co. has established for its office men, superintendents and foremen a well-appointed club, occupying quarters in a former mansion house near the works, where, for a nominal yearly fee, members are given all the benefits usual to such organizations. During the noon hour a course dinner is served at approximately what the service actually costs, and supper may also be had by those who are obliged to stay late at the office.

As the club building stands in a residence district and is easily accessible from all parts of the city, it is kept open every evening for the benefit of members, who make free use of the periodicals and games contained in the reading room. Nights are also frequently set apart for general receptions and entertainments given separately by members of either sex, the annual dues being devoted to a fund for such purposes.

Piping and Power Station Systems.—XVII.*

BY WILLIAM L. MORRIS, M. E.

There is another type of atmospheric valve, illustrated in Fig. 152-(BI-12), which is frequently furnished by the engine builders. This valve is intended to be positively operated by hand, instead of being automatic in closing. The valve must be held in position

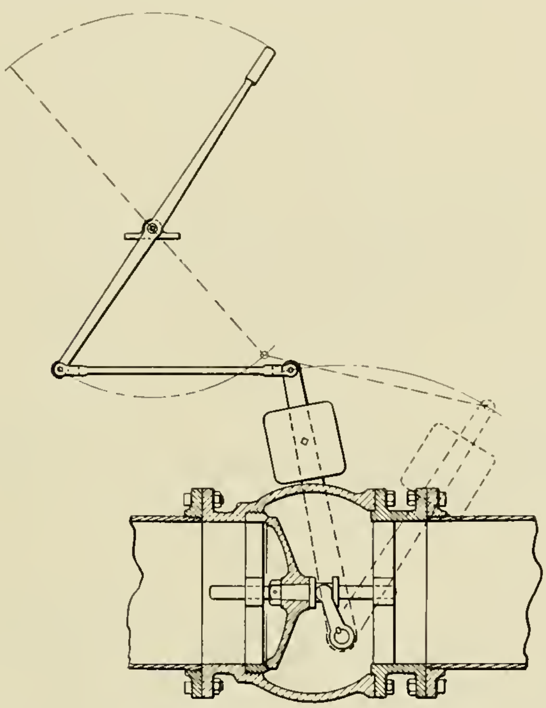


FIG. 152—(BI-12).

on its seat until vacuum has been introduced on the line, after which the valve will be held shut by reason of the difference in pressure due to the vacuum. In case the vacuum valve is motor operated it can be thrown in and the atmospheric valve partially closed with the hand lever. The operator will then be able to ascertain, by feeling, when the vacuum is increasing in the line, and can force the valve to its seat and hold it closed.

With this valve, the objectionable feature of chattering can be practically eliminated. There is nothing that injures the valve faces of an atmospheric valve as much as this continuous chattering. On valves of 20 in. diameter and over, the chattering becomes particularly severe. A 20-in. valve will have an area of 314 sq. in. and if the travel of the valve is 5 in. and that of the hand lever 30 in., it would be possible to hold the valve against a 1-lb. back pressure or 2 in. of vacuum by exerting a pressure of 50 lb. on the lever. There are other objections to this valve, one being that it is a difficult valve to re-grind and keep in perfect alignment with its face. This is a fault common to all beat valves which lie on their sides. Another objection is that a water seal cannot be used to shut off any leaks which may occur.

There are certain essential features that an atmospheric valve should possess to meet the requirements in the most efficient manner: The valve should be of the beat form, the valve face should be placed in a horizontal position; a water seal should be provided for the valve seat; a cap plate, which may easily be removed, should be provided to facilitate inspection or regrinding; the valve should be rotatable with respect to its operating lever or guides, so that the same device that is used to raise the valve from its seat will be an aid in regrinding; when the cap plate is removed all the valve guides should be in place to allow a proper regrinding; the dash pot should be of such a form and so located that it can readily be inspected and kept in good order and some means should be provided for holding the valve off its seat when the engine is to be run non-condensing.

The sizes of an atmospheric valve and pipe may be considerably less than those of similar parts on a vacuum line because of the difference in the volumes of steam at atmospheric pressure and under vacuum. The volume of a given amount of steam at 26 in. of vacuum is seven times that of the same steam at atmospheric pressure. It is thus seen that the area of the atmospheric connections can be made one-seventh the size of those for the vacuum line and still maintain the same velocity of flow. There would, however, be but a slight loss in case the velocity flows varied, since the atmospheric connection is in use but a small portion of the time.

For fixing the relative dimensions of the different engine connections of a compound engine, so that the flow will be the same at all parts, the following argument should be considered:

The volume of live steam at 160 lb. pressure which would flow into the high-pressure cylinder for one-quarter of the stroke until cut off may be arbitrarily assumed as 1. The steam in the high-pressure cylinder will expand its volume six times in exhausting to the receiver, but as the flow from the live steam main into the high-pressure cylinder was cut off after one-quarter of the stroke, and as the exhaust to the receiver takes place during the full stroke, the relative areas of the admission and exhaust ports are not as 1 is to 6, but as 1 is to $6 \div 4$; or the exhaust port should have an area $1\frac{1}{2}$ times that of the admission port. As the steam in the receiver has expanded to six times its original volume in the high-pressure cylinder, the admission valves of the low-pressure cylinder, in order to prevent any accumulation of steam in the receiver, should have an area of six times the admission valves to the high-pressure cylinder since the valves of both cylinders cut off at one-quarter stroke. If the low-pressure cylinder exhausts

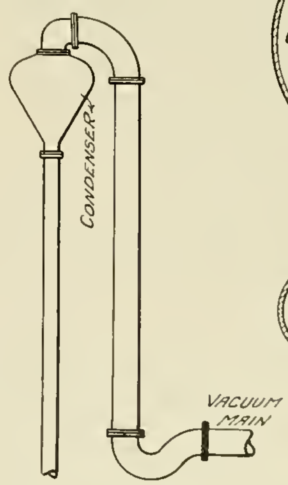


FIG. 153—(BI-13).

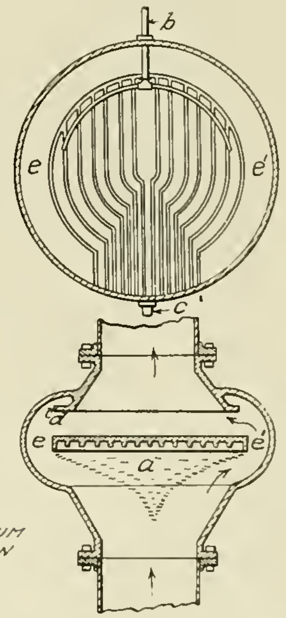


FIG. 154—(B4-1).

to 26 in. of vacuum the steam in the condenser will occupy 72 times the volume it did in the high-pressure cylinder up to the time of cut-off, but as the exhaust ports of the low-pressure cylinder are open to the condenser during the full stroke and the admission ports from the receiver to the low-pressure cylinder are open

but one-quarter of the stroke, the necessary area to maintain an even flow will be one-quarter of 72, or 18 times the area of the live steam ports of the high-pressure cylinder. In case the engine exhausts to atmosphere the relative volume of live steam to steam at atmospheric pressure will be as 1 to 10, but the live steam flows into the engine only one-quarter of the time and the exhaust steam flows to atmosphere during the full stroke. Therefore, instead of the atmospheric valves having an area 10 times as great as that of the admission valves, the area need be but 2½ times as large to maintain the same velocity of flow. The foregoing argument reduced to diameters appears as follows:

Pressure lb.		Volume.	Area.	Diam.
160	Steam to the High-Pressure Cylinder......	1	1	1
10	Exhaust from the High-Pressure Cylinder..	6	1½	1.22
10	Steam to the Low-Pressure Cylinder......	6	6	2.45
0	Exhaust from the Low-Pressure Cylinder..	10	2½	1.58
26*	Exhaust from the Low-Pressure Cylinder..	72	18	4.24

*Inches of vacuum.

Following this argument, if the steam line is 10 in. in diameter, the exhaust to the receiver will be 12¼ in. in diameter and the

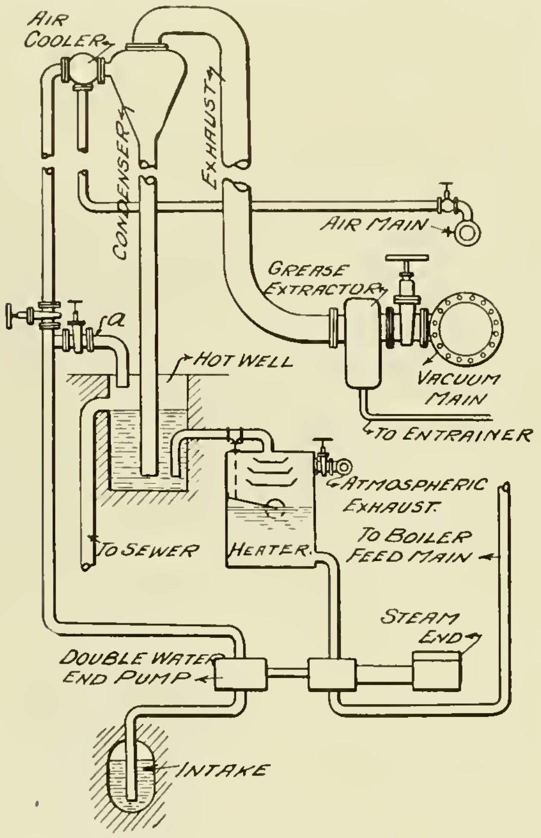


FIG. 155—(B4-2).

steam line to the low-pressure cylinder will be 24 in. in diameter. The atmospheric exhaust will be 16 in. in diameter. The vacuum exhaust is usually made by the engine builders twice the size of the live steam line giving the exhaust steam a velocity four times that of the live steam.

The tendency in engine building is to make the connections to the high-pressure side of an engine larger and to the low-pressure side, smaller than is necessary. In receiving bids for engines, the engine builder should be required to state the size of the port openings, as the efficiency of an engine is considerably affected by the frictional losses in the restricted area of the low-pressure ports. The atmospheric connection can consistently be made three-eighths of the diameter of the vacuum exhaust and still maintain the same velocity of flow in the atmospheric connection as in the vacuum connection. In other words, a 9-in. atmospheric pipe could be used in connection with a 24-in. vacuum line. This ratio is rather extreme in practice and it is not used. The low-pressure port opening in the exhaust valve of a compound engine having a 12-in. live-steam connection will have an area of 5 x 64 in. or 320 sq. in. This is 2.83 times the area of the steam pipe and corresponds to a diameter of 1.68 when the diameter of the live-steam port is 1. It will be noted that this area is but slightly greater than that required to exhaust to the atmosphere and maintain the same velocity for the exhaust as for the live steam. If the port-ways in the low-pressure cylinder are made larger, the cost of the low-pressure cylinder will be materially increased.

With an elevated jet condenser installation it is a rather general practice to place an entrainer at the lower end of the riser to the condenser as shown in Fig. 153-(B1-13). The principle of the entertainer is that instead of the water of condensation lying at the bottom of the entire vacuum main, the condensation flows into the trap-shaped fitting and congests the passageway for the steam to such an extent that the steam will pick up the water and carry it up and into the condenser. But very little condensation will be held in the trap before it fills up to a point where the steam will carry it. Instead of allowing a long main to become filled with condensation for one-quarter of its length on light loads, which condensation is later picked up on heavy loads and thrown against the elbows of the main, the entrainer allows but little water to lie in any part of the line. It is of course necessary that the main be given a decided pitch toward the entrainer. This method of removing condensation has been found very satisfactory.

Another method of removing the drips from a vacuum main is by means of a vacuum trap. A vacuum trap is quite interesting in its intricacies of steam, drip and discharge connections, and also in its automatic arrangement for opening and shutting these connections at the proper time, but as a power station appliance, a vacuum trap is considered a troublesome device; usually some means other than the use of such traps can be devised to drain the lines if the idea is kept in mind while laying out the vacuum system. If other disposition of condensation has not been provided for, a vacuum trap should be used as a last resort. It is the elimination of such devices that shows careful and competent station engineering.

Grease Extractor.

The usual type of grease extractor has the same form as a steam separator. The oil carried with the steam is in combination with the condensed vapors. The principle of operation of the separator is to lessen the velocity of the steam before changing its direction of flow and thus allow the heavier particles of grease to continue in the same direction as when entering the separator and be deposited on a "baffle" which is out of the path of the steam.

Fig. 154-(B4-1) illustrates the general principle of all grease extractors with a few minor changes in the location of the baffles. There is no current in the space indicated by a, since the ribs on the baffle prevent any flow across its face. A water spray is introduced through the pipe shown at b, which further reduces the temperature of the mist on the baffle and conveys it down to the drain pipe shown at c. The lip, d, is provided to prevent oil from creeping on the inner surface of the separator, which might be due to the flow of the impinging steam, and being carried to the condenser. The water spray is also connected with this ring. The spaces indicated by e and e' are the passages for the steam. The drain, c, is run to a vacuum trap or an entrainer. The drain, c, is one that should not be carried to the condenser and in order to eject water, the entrainer is quite necessary. The discharge from the entrainer should go to a sewer or to a large grease trap. If a grease trap is used, all drips containing any oil should be run into the same system throughout the plant. This system will be described more fully in a later chapter.

With surface condensers the oil is removed from all the exhaust steam since all the condensation is returned to the boilers. However, if jet condensers are used, it is quite difficult to remove the oil from all of the exhaust and quite useless since only from three to five per cent of the exhaust steam is returned to the boiler, the remainder being discharged with the tail water from the condenser to the stream from which the water is taken. If a cooling pond or tower is used, all exhaust steam should be run through a vacuum separator. Unless this is done, the greater portion of the cylinder oil will be discharged into the cooling pond or tower. The interest on an investment for grease extractors will be recovered by the lessening of boiler repairs and by the reclaiming of oil and grease. The reclaimed grease cannot be used again in the oiling system but there are many other valuable uses to which it can be put.

For a jet condensing plant, a very efficient arrangement is to use a small elevated jet condenser for the boiler feed water only. There may be two large station condensers for a station generating 120,000 lb. of steam per hour and a small condenser that will circulate 120,000 lb. of cooling water per hour or at a rated capacity of 4,000 lb. of steam per hour. This latter would be about one-thirtieth of the capacity of the entire plant. This small condenser may have air taken from it through the regular air main used for the main condensers. The small condenser would have only the feed water passing through it and the hot-well water would be maintained at a high temperature, possibly 10° higher than in the large condenser. The oil could be eliminated from this condenser by using the grease extractor as shown in Fig. 155-(B4-2).

If the plant is supplied with two 30-in. condensers, the small condenser should have an 8-in. exhaust connection, about a 4-in.

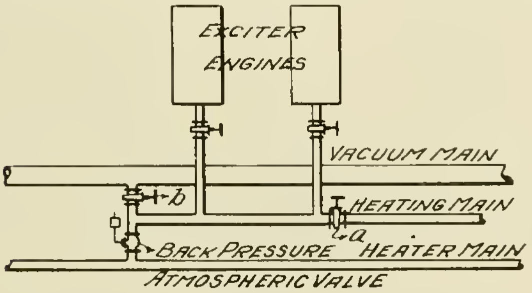


FIG. 156—(B6-1).

circulating water connection and a 5-in. tail pipe. The cost of this condenser will be low and ordinarily the fuel saved will more than cover the increased cost of installation. Should the small condenser not be used the boiler feed water would have to be handled in the large condensers thereby increasing the capacity of the plant in condenser capacity. No extra pumps or machines are required to operate the small condenser. The double-water-end pump would be required in any case. If the condenser is not used, the low-pressure pump would be used as the heater pump. The by-pass connection, shown at a, is used when the condenser is not in operation. Due to the float valve closing the discharge to the heater, the small amount of surplus hot-well water will discharge through the overflow. To avoid the use of an entrainer, the drips from the grease extractor may be run to the dry vacuum pump since there will be but one-thirtieth part of the steam flowing to the small condenser. The dry vacuum pump will handle considerable moisture without causing any serious difficulty.

Vacuum Connection to the High-Pressure Cylinder.

In Fig. 134 were shown the steam and exhaust lines to the high and low-pressure cylinders and also the lines to the condenser and to the atmosphere. The valves, f and g, are the throttles for the high and low-pressure sides and should be provided with floor stands and hand wheels close to the valve gear. These stands should be so placed as not to interfere with the removal of the valves and pistons. The valve, a, is a pressure-reducing valve. The valves in the exhaust from the high-pressure cylinder and also the one next to the low-pressure cylinder, are only operated when one side of the engine is out of service and the other side is to be run as a single-cylinder engine. Operating devices for such valves, running through the floor, are neither necessary nor desirable. The valve, d, should be either motor or hydraulically operated. The valve, e, is the atmospheric self-opening and closing valve. The valve, b, is the relief valve to prevent the pressure from running too high on the receiver.

It will be noted that the receiver is used when the low-pressure cylinder is operated with steam passing through the reducing valve, and also that the reducing valve discharges into the receiver and not into the line to the low-pressure cylinder. These two features should not be overlooked because otherwise money will be wasted for these low-pressure connections and at the same time the reducing valve could not be operated.

Reducing valves have been connected to low-pressure cylinders without receivers and have failed completely in controlling the pressure. There must be a large volume of steam between the reducing valve and the cut-off valve of the engine in order to avoid the constant jumping of the valve. Usually this volume should not be less than that of the cylinder. The pipe from the receiver to the low-pressure cylinder will cause a greater drop in pressure during the flow of steam than will the receiver. In order to produce a more steady flow through it, the reducing valve should be discharged direct to the receiver and not into the branch from the receiver. If the engine has no receiver, the pressure reducing valve should be located away from the cylinder as far as would be necessary to give an area to the pipe equal to the area of the low-pressure cylinder. It will be noticed in Fig. 134 that the high-pressure cylinder can exhaust either to the condenser or to the atmosphere when the low pressure is off, and that the low-pressure side will act in the same manner when the high-pressure side is off.

Vacuum Connections to Auxiliaries.

In most cases a condensing plant can be laid out so that only the pumps and single-valve engines used for stokers, stacks, etc., will exhaust into the heater. These machines would show only about a 10-per cent increase in power if they were run condensing. In order to be able to determine how many of the auxiliaries should be run to the heater or to the condenser, the B. t. u. losses under various conditions and when run condensing and to the heater, should be considered as follows:

1. If live steam at 160 lb. pressure is fed to an auxiliary that exhausts to the atmosphere it will require 1,195 B. t. u. per lb. of steam.

2. If live steam at 160-lb. pressure is fed to an auxiliary using 90 per cent of the steam when run condensing, it would require 1,075 B. t. u. per lb. of steam.

3. With the same conditions as in No. 2, but using 80 per cent of the steam, the auxiliary would require 956 B. t. u. per lb. of steam.

4. With the same conditions as in No. 2, but using 70 per cent of the steam, the auxiliary would require 836 B. t. u. per lb. of steam.

5. If live steam at 160-lb. pressure is fed to the auxiliary, delivering 90 per cent of the steam and 10 per cent of the condensation to the heater, it would require 146 B. t. u. per lb of steam.

6. With the same conditions as in No. 5, but delivering 50 per cent of the steam to the heater and 50 per cent to the atmosphere, the auxiliary would require 622 B. t. u. per lb. of steam.

7. With the same conditions as in No. 5, but delivering 30 per cent of the steam to the heater, the auxiliary would require 802 B. t. u. per lb. of steam.

8. With the same conditions as in No. 5, but delivering 10

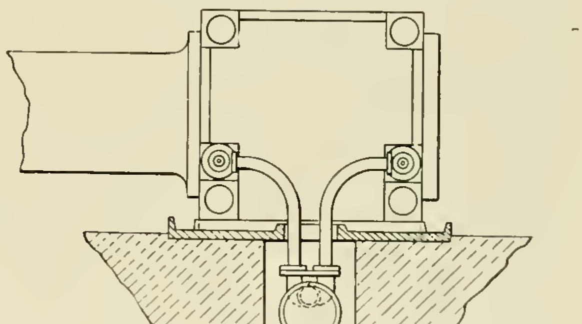


FIG. 157—(B7-1).

per cent of the steam to the heater, the auxiliary would require 1,080 B. t. u. per lb. of steam.

It will be seen from the foregoing that auxiliaries using a large amount of steam per horse power or in other words, auxiliaries that show but a slight decrease in steam consumption when run condensing, are most economical when exhausting to the heater. In No. 2, for instance, where the auxiliary runs condensing, there is required the consumption of as many heat units as under the conditions illustrated in No. 8, where the pump uses but one-tenth of its steam in the heater, the remainder being wasted to the atmosphere. In No. 4, which illustrates the economy of a compound condensing unit, the consumption of heat units would be less if, as in No. 7, it were delivering but 30 per cent of its steam to the heater and were running non-condensing.

In the effort to secure high economy, electrically driven auxiliaries are frequently used, the idea being that the economy of the auxiliaries will be nearly that of the large main units. For example, an electrical auxiliary may require through its main unit, but 16 lb. of steam per horse power, which at 1,195 B. t. u. per lb. would be a total of 19,120 B. t. u. per hour. If a steam auxiliary, run non-condensing, is used, all of the exhaust being used in the heater, as in No 5, the consumption would be 146 B. t. u. per lb. of steam or 14,600 B. t. u. per hour. This represents a saving of 4,520 units, which would be a saving in steam over the motor drive of 24 per cent. The question now arises as to where the dividing point is between operating condensing and non-condensing to the heater.

In the first place, water delivered to the heater at from 90° to 100°, as would be the case from the hot-well delivering the water at 210°, would require from 10 to 11 lb. of exhaust steam for each 100 lb. of feed water. More than this amount of exhaust could not be condensed and the excess would waste to the atmosphere. The auxiliaries should be arranged to furnish all their exhaust steam to the heater provided this exhaust steam does not exceed from 10 to 11 per cent of the whole amount of steam generated by the boilers. When the exhaust steam is wasting to the atmosphere an amount equal to 75 per cent of the whole amount delivered by a compound engine or 90 per cent of that delivered by a pump, it will then be slightly better economy to connect such a machine to a condenser. It is useless to connect the large generating units to the heater. In the case of four units, there would be 25 per cent of the steam delivered to each unit and if exhaust could not be obtained from any other source, it would then be necessary to condense 30 per cent of the exhaust in the heater in order to equal the economy of the condenser. In other words, 7.5 per cent of the station steam would be delivered by one of the generating units alone. When the auxiliaries are added to this, there would then be about 15 per cent of the steam generated to be condensed in the heater, which would not be possible. In most cases, not more than 10 per cent of the exhaust of one of the large units could be used and if the exciter engine be exhausted to the heater, the auxiliaries being, as they generally are, steam consumers, no additional steam can be condensed. It is customary to allow about 10 per cent of the station steam for the requirements of the auxiliaries, which is practically all that the heater will take economically.

The exciter engine should be piped both to the condenser and to the heater main if the heater is able to condense one-half of the steam from the heater main together with that from all the other auxiliaries. The small pumps, stoker engines, etc., should be connected to the heater main only. It is seldom that the exhaust from the heater main can not be condensed and the saving effected by running the heater main condensing would be very slight. Assuming that the large unit uses 15 lb. of steam per h. p. hour, it costs not less than 1 per cent of the whole power of a large unit to operate the condensing apparatus. Since pumps and other auxiliary apparatus require from 6 to 7 times this amount of steam per horse power hour, it would require from 6 to 7 per cent of the pump power to operate condensing machinery that will effect a gross saving of 10 per cent leaving a net saving of but 3 to 4 per cent in the steam consumption of the pump. The amount of steam available in the shape of pumps, stoker engines, etc., should be determined and also the possible demands in the shape of exhaust steam for the heating system. It can then be better determined whether some of the small generating machinery is to be arranged to run either condensing or non-condensing.

Another detail that enters into the consideration of exhaust steam lines is the exhaust heating system. In Fig. 156-(B6-1) is shown a simple arrangement of the exhaust heating system from exciter engines. The valve, a, is closed when the heating system is not in use and the valve, b, is open when the heating system is run condensing. When both a and b are closed, the exciter engines will exhaust to the heater. The back-pressure valves serve both for atmospheric relief and for relief in case the pressure in the heating main exceeds the pressure as set. All the main units should be on the vacuum main and all other auxiliaries should be on the heater main. The horse power required for the different auxiliaries per pound of steam generated will be given in a later chapter, and in laying out the station the machines may be selected and arranged so that they will give only the amount of steam required for the different classes of service. This is another instance where the nature of the system must be fully determined before the machinery is purchased or in any way decided upon. The ideal system is one which will deliver to the heater all the steam it will condense and at the same time not waste to the atmosphere more than one-half of the exhaust of any machine.

Branch for Low-Pressure Cylinder Reliefs to the Vacuum Lines.

The cylinder reliefs on an engine are frequently left open to the atmosphere to show when they are "snifting." The actual working service of this valve is quite insignificant, since it is very seldom in operation. The valve is placed in such a position that it will relieve the cylinder of any excessive pressure which may be caused in them by improper valve setting or by excessive compression. The high-pressure side may be left open to the atmosphere provided the engine and the relief valves are properly set and do not show any leakage that may cause trouble. Unless the low-pressure cylinder relief valves are kept absolutely tight, they will cause considerable trouble on account of the air which is liable to leak into the vacuum lines. To avoid this difficulty, these valves are frequently piped to the exhaust from the low-pressure cylinder.

The connections shown in Fig. 157-(B7-1) will work up very nicely, using flanged relief valves, cast iron bodies, pipe bends, an opening in the bed plate for the pipe to pass through and flanged faces on the exhaust elbow to which are attached the relief pipes. The corliss valves can be removed without interfering with these.

(To be continued.)

A Test of Flake Graphite.

Professor Goss, of Purdue University, recently made a number of tests which demonstrate the value of graphite as a lubricant and show its mechanical affinity for metal surfaces. Since it was deemed desirable to use as light an oil as was obtainable, the lubricating mixture used was that of kerosene and Dixon's flake graphite. An attempt to use a water mixture proved unsatisfactory because of the tendency of the rubbing surfaces to corrode under its influence.

In operating the testing machine under kerosene lubrication for a considerable period, it was found that the heaviest pressure that could be sustained by the rubbing surfaces was 50 lb. per sq. in. of surface and the lowest coefficient of friction developed was .00547.

When the machine had made 633,287 revolutions a mixture, by weight, of two parts kerosene and one part of the graphite was made. After 10,000 revolutions occupying a period of something less than 30 minutes, the coefficient of friction became 83.0 per cent of that obtained by the use of kerosene alone. The conditions thus secured were continued during more than 400,000 revolutions of the test machine and the pressure between the rubbing surfaces was subsequently increased by increments of 10 lb. until a maximum of 110 lb. per sq. in. had been secured. The observations show that as the pressure was increased, the coefficient of friction diminished, the minimum value being .00296.

Having secured these results it was next sought to ascertain the endurance of the graphite as a lubricant. This was done by removing all graphite from the machine and by rinsing all parts involved, including the rubbing surfaces, with kerosene, after which the machine was operated under a pressure of 100 lb. per sq. in. in the presence of kerosene alone. Under these conditions the lubrication was aided by such particles of graphite as naturally adhered to the rubbing surfaces. It was expected, however, that these particles of graphite would sooner or later disappear and the conditions would return to those originally found for the kerosene alone. Each morning the rubbing surfaces were removed from the machine and all parts carefully rinsed for any particles of graphite and the work of the day proceeded usually to the extent of 150,000 revolutions. After eight days running and 978,000 revolutions, no diminution in effect could be discovered.

Bulletin of Purdue University.

The annual catalog of Purdue University of Lafayette, Ind., has recently been issued. The publication contains an account of the origin and purpose of Purdue University, a description of the buildings, equipment, courses of study, requirements of admission and a register of the students. From an examination of the courses of study and equipment, it will be seen that the university compares favorably in these respects with its sister colleges in both the East and West.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Kenfield Publishing Co. under the title "Street Railway Law," five volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901 to 1903; Vol. V, from April, 1903, to August, 1905. Price: Bound in sheep; five volumes, $12.00; single volume, $3.00. Bound in buckram; five volumes, $8.00; single volume, $2.00.]

FACING TO REAR WHEN ALIGHTING FROM CAR—PASSENGER ALIGHTING MAY ASSUME CAR WILL REMAIN STATIONARY.

Birmingham Railway, Light & Power Co. vs. Handy (Ala.), 39 So. Rep. 917. June 6, 1905. "Not officially reported."

The plaintiff's testimony tended to show, the supreme court of Alamaba says, that the car was stationary when she attempted to step from the running board to the ground, and that just as she was in the act of alighting the car was suddenly started with a jerk that precipitated her to the ground. It cannot, therefore, be affirmed as matter of law that the plaintiff was guilty of negligence in attempting to alight with her back in the direction in which the car had been going. Indeed, if it be true that her injuries were occasioned by a sudden start of the car while she was in the act of alighting from the running board, it may be affirmed as a matter of law that the fact that she stepped in an opposite direction from which the car had been moving before it stopped, if true, would not be negligence. She had the right to assume that the car would remain stationary until she alighted. She was not required to anticipate that it would be moved. There is no more danger in stepping from a car that is standing still than there is from any other stationary object; and confessedly the direction in which one may alight from a stationary object is of no consequence.

PASSENGERS ASSAULTED BY EMPLOYES NOT ENTITLED TO EXEMPLARY DAMAGES AS MATTER OF LEGAL RIGHT.

Berg vs. St. Paul City Railway Co. (Minn.), 105 N. W. Rep. 191. Dec. 29, 1905.

In an action to recover damages for an assault alleged to have been committed upon the plaintiff by the defendant's employes, who were in charge of a car on which he was a passenger, the supreme court of Minnesota holds that, where the act of a defendant, which is the subject-matter of the action, is shown to have been wanton, or malicious, or fraudulent, or oppressive, and of such a character as to indicate that he acted with a reckless disregard of the rights of the plaintiff, the jury in their discretion may award to the plaintiff, in addition to his compensatory damages, such further reasonable sum as exemplary damages as they may deem just; but the plaintiff is not entitled to such damages as a matter of legal right in any case.

LIABILITY FOR INJURY TO PASSENGER FROM MISCONDUCT OF CONDUCTOR ON ANOTHER CAR—CARE REQUIRED TO PROTECT PASSENGERS FROM INJURY BY MISCONDUCT OF OTHERS.

Hayne vs. Union Street Railway Co. (Mass.), 76 N. E. Rep. 219 Dec. 1, 1905.

The plaintiff, a passenger, was riding near the front window, on a seat in the corner of the car. The car entered upon a turnout to pass two other cars, going in the opposite direction, which were waiting there for the plaintiff's car to go by. The conductor of one of these cars, who had picked up a dead hen on the beach near the road, threw the hen in sport at the motorman on the car on which the plaintiff was riding. He missed the motorman, and his missile struck the window, broke the glass, and thereby injured the plaintiff. The supreme judicial court of Massachusetts holds that the street railway company was liable for the misconduct of the conductor, although he was not employed upon the car in which the plaintiff was riding.

The court says that it will assume in favor of the defendant that there was no evidence to warrant a finding that the conductor who threw the hen was acting within the scope of his employment, and therefore, under the rules of law applicable to the ordinary relations of master and servant, the defendant would not be liable for the servant's act. But the plaintiff invoked a special rule applicable to common carriers. A common carrier of passengers impliedly agrees to exercise the utmost care and diligence, consistent with the proper management of his business, to protect his passengers from injury through the misconduct of other persons, while he is performing his contract for their transportation. They necessarily submit themselves in a large degree to his care and control, and he undertakes to provide for their safety in all those particulars which ought to be under his direction and management. Among these, to a certain extent, are the kind of persons permitted to approach the passengers on the carrier's premises, and the rules and regulations which govern the conduct of the carrier's servants and others, while the contract for carriage is being performed. While the carrier does not guarantee perfection in these particulars, he is under an obligation of implied contract, and consequent legal duty, to use a very high degree of care to prevent injuries that might be caused by the negligence or willful misconduct of others. This rule prevails generally in the American courts. In the application of the rule to injuries caused by servants of the carrier while engaged in the performance of his contract of carriage, it is held that he is liable absolutely for their misconduct.

Under the authorities, it is plain that, if the wrongful act which caused the injury in the present case had been done by the conductor or motorman of the car on which the plaintiff was riding, the defendant would be liable. The only question upon which there is ground for any doubt is whether the rule applies to an injury done by a servant who was engaged in the same general service, but was employed upon another car, and was not charged directly and primarily with any duty to provide for the safety of the plaintiff. The court is of opinion that the liability of the defendant is the same as if the conductor who threw the hen had been in charge of the plaintiff's car. The rule of liability in such cases is made absolute. The reason for the rule applies as well when the servant is employed upon another car as when he is working on the car upon which the injury occurs. If one of the reasons for the liability is that the servant, through his relation to the master, owes a duty to protect the passenger from injuries by others, and a fortiori (by a stronger reason) from injuries by himself, this duty, so far as it relates to the last branch of the obligation, is not confined to servants the nature of whose service requires them to give personal attention to the passenger in reference to possible injuries from others, but it includes those employed in the general business of transportation, and involves a duty to refrain from doing injury to any of the master's passengers, whether in the special charge of the servant or not. It would be too strict and narrow a rule to hold that this liability of the master extends only to injuries by servants especially charged with the duty of protecting passengers from injury.

The great diligence and learning of the defendant's counsel discovered for the court's enlightenment no case in which it has been held that the carrier was not liable, because the servant, at the time of his wrongful act, was not directly employed in carrying the passenger injured, if he was engaged in the general business of which the transportation of the passenger was a part. Of course, if he was at the time in a position wholly disconnected with his duties to the carrier, as, if his misconduct was away from his place of employment at an hour of the day when he was at liberty to go where he pleased, the master would not be liable. But the mere fact that he was on one car and his wrongful act was directed to a passenger on another car, should make no difference with the master's liability.

MAY PROVE BY ACCIDENT CLERK ABSENCE OF NOTICE OF ACCIDENT TO EXPLAIN FAILURE TO CALL WITNESSES.

Hirsch vs. Union Railway Co. of New York City (N. Y. Sup.), 96 N. Y. Supp. 333. Nov. 24, 1905.

There was error, the appellate term of the supreme court of New York holds, in a refusal to permit the defendant's accident clerk to testify as to whether or not the company had received notice of the accident here in question. It says that the failure to call any witnesses was calculated to prejudice the jury against the defendant, and it should have been permitted to explain why it presented no defense.

CARE OWED TO PERSON BOARDING CAR WHICH HE IS THEN TOLD IS GOING TO STABLES ONLY AND WHO THEREUPON ATTEMPTS TO ALIGHT—NOT A PASSENGER.

Robertson vs. Boston & Northern Street Railway Co. (Mass.), 76 N. E. Rep. 513. Jan. 3. 1906.

The plaintiff, thinking it was a proper car to take him home, boarded one which had stopped at a stopping place on the signal of some other person who wished to alight. After he had taken a seat the conductor called out, "This car goes to the stables only." in consequence of which, he attempted to get out and was injured by the car suddenly starting, throwing him. Upon the undisputed facts, the supreme judicial court of Massachusetts says, the plaintiff had not been accepted by the defendant as a passenger at the time of the accident, and had himself abandoned the intention of becoming one upon hearing the announcement by the conductor. The court, therefore, properly instructed the jury that the defendant was bound to exercise ordinary care only.

AUTHORITY IN CHARTER TO ACQUIRE NECESSARY PROPERTY DOES NOT AUTHORIZE CONDEMNATION —STATUTES TO BE STRICTLY CONSTRUED—AUTHORITY TO TAKE LAND FOR POWER PLANTS DOES NOT AUTHORIZE CONDEMNATION OF LAND AND WATER PRIVILEGES TO GET POWER.

Claremont Railway & Lighting Co. vs. Putney (N. H.), 62 Atl. Rep. 727. Dec. 5, 1905.

The plaintiff being by its charter authorized, among other things. "to lease, hold, purchase, and acquire such real and personal estate as may be necessary and convenient in the prosecution of its business," it was contended that it was to be implied from the use of the word "acquire" in its charter that the legislature intended to confer upon it the power to take by eminent domain such property, real and personal, as might be necessary to the prosecution of its business. But the supreme court of New Hampshire says that the answer to this was that as the exercise of this power was against common right, and the plaintiff's charter did not expressly confer the power, or point out the steps to be pursued in its exercise, or make provision for compensation, the presumption was that the legislature did not intend to confer it. Private property cannot be invaded by this power without statutory authority, and statutes which are claimed to authorize its exercise are to be strictly construed.

Moreover, the provision in section 4 of chapter 27 of the laws of 1895, as amended by chapter 93 of the laws of 1901, that "said railway corporations may take and hold * * * such land as may be necessary for the purposes of installing and maintaining power plants," the court does not consider authorizes street railway corporations to condemn land and water privileges for the purpose of diverting streams and procuring power with which to operate power plants erected or to be erected on their own land. On the contrary, the court says, the authority there conferred is limited to taking such land as may be necessary for locating or placing power plants in position for use, and maintaining the same. This construction gives to the words used their natural and usual meaning, and such as is recognized by leading lexicographers.

REQUIRED TO PAY EXCISE TAX IMPOSED ON EARNINGS OF STREET RAILWAY CORPORATIONS.

McDonald vs. Union Freight Railroad Co. (Mass.), 76 N. E. Rep. 655. Jan. 3, 1906.

The only question in this case, the supreme judicial court of Massachusetts says, was whether the defendant corporation was subject to an excise tax, under sections 44-46 of chapter 14 of the revised laws, which impose such a tax upon the earnings of street railway corporations. The defendant is not strictly a street railway company, within the statutory definition found in Section 1 of Chapter 111 of the revised laws, for this definition includes only railroads or railways operated by motive power other than steam. The defendant's charter, while giving it authority to use all kinds of power employed by street railways, provides that "the cars of said road may be drawn during the night by steam power, subject to the regulation of the said board of aldermen." Since 1874 the corporation has used nothing but steam as its motive power, but in nearly all other respects it is like street railways. Section 1 of the charter provides that "said corporation shall have all the powers and privileges, and be subject to all the duties, restrictions and liabilities set forth in all general laws, which are now or hereafter may be in force, relating to street railway corporations, so far as the same may be applicable." In City of Boston vs. Union Freight Railroad Co., 181 Mass. 205, 63 N. E. Rep. 412, the various statutes showing its history and character, and particularly its resemblance to street railways, were considered at length, and it was pointed out that the legislation touching the repair of streets by street railway companies was equally applicable to this corporation. The fact that "other railroad corporations" are not liable to the payment of an excise tax upon earnings is not a sufficient reason for holding that this corporation should not pay such a tax, especially since it has been relieved from the care of streets by the same law that relieves street railways from such care. The fact that the tax, when paid, is differently applied from the tax on street railway companies, is not a sufficient reason for holding that it should not be imposed. As the payment of such a tax is one of the duties and liabilities of street railway companies, and as there is no good reason why the statute requiring it should not be applicable to the defendant, the court is of opinion that the tax was properly imposed, under the provision of the charter already quoted.

CARE REQUIRED IN EQUIPPING CARS—AUTOMATIC SAND BOXES—SUFFICENT INSTRUCTION OF MOTORMAN—NEED NOT UNDERSTAND MECHANISM OF CAR—RISK FROM FAILURE TO USE SAND ASSUMED.

Mayer vs. Detroit, Ypsilanti, Ann Arbor & Jackson Railway Co. (Mich.), 105 N. W. Rep. 888. Dec. 30, 1905.

A motorman was injured by his car running away on a steep grade and off the track at a curve. It was in winter, on a day when the track was made slippery by the frost coming out of the rails. There was no testimony that the car was not supplied with a pail of sand and a shovel, as the other cars apparently were, but it was argued that there should have been provided sand boxes and sand which could be used automatically, and one witness stated that he believed that it would have been good railroading to have supplied same upon the cars. Asked what he meant by good railroading, the witness said that it was that everything should be done possible in equipping a car to insure safety. But the supreme court of Michigan says that this was not the rule, and rendered this witness' opinion valueless, so that his testimony should have been stricken out. Ordinary care was the rule applicable to this case. The means furnished must be those which, measured by the standard of good railroading as actually conducted, could be said to be reasonably safe. However, a majority of the court thinks there was evidence tending to show that the defendant was negligent in not equipping its cars with automatic sand boxes.

Again, the court says that it found nothing upon the record to indicate that the plaintiff was not instructed in the usual manner and for usual time considered necessary to enable motormen to run one of these cars alone. It is not a difficult thing to do. It

was not necessary, neither was it expected, that he should understand all the mechanism of the car. No scientific knowledge was required. When he had been instructed and had learned how to control such mechanism by the use of the lever and the brakes, he had acquired all that is essential. If anything happened to disable his car, the rules required him to have the next car take it back to the barn for repairs. He is not, as is a railway engineer, required to understand the mechanism of the machine and be able to repair it. That duty was very wisely left to others, educated for that purpose.

The plaintiff knew for what purpose the sand was used; he knew its effect as well as any one; he knew the danger of its absence as well as any one; and if he had it upon the car, and failed to use it when he saw the slippery condition of the track, he should be held to have assumed the risk.

ADMISSIBILITY OF EVIDENCE OF SPEED OF CAR FROM SWITCH IN WHICH FIRE FLASHES AND PASSENGER JUMPS—CONDUCTOR JUMPING FROM CAR—CARE REQUIRED IN MATTER OF EMPLOYES AND USE OF ELECTRICITY.

Blumenthal vs. Union Electric Co. (Ia.), 105 N. W. Rep. 588. Jan. 11, 1906.

While a car was rapidly descending a steep grade on a street flashes of fire, accompanied by smoke and hissing noise, appeared around the forward switch in the car, whereupon a certain woman passenger and others jumped from the car, the passenger in question receiving injuries in alighting which caused her death soon thereafter. Testimony was admitted tending to show that, immediately before and at the time the fire appeared, the car was running at a high rate of speed, and that it had a rocking or bouncing motion, and also that the track was uneven. The defendant asked that such evidence be limited to the question of its negligence in causing the fire. The supreme court of Iowa holds that there was no error in a refusal to so limit it. It says that it was, of course, possible that the woman may have left the car solely on account of the fire, but the evidence was by no means conclusive on this point. Her action may have been influenced by the combination of speed and flame, for both of which the defendant may have been liable. No one could say definitely as to this. It was a question for the jury to determine from all of the facts and circumstances surrounding her at the time, and it was therefore entirely proper to submit for its consideration all of those facts and circumstances.

There was evidence tending to show that when the fire appeared the conductor of the car became frightened and jumped from the car before the woman did, and that, while the motoneer remained at his post, he said nothing to quiet the alarm of the passengers. The defendant asked that this be considered only on the question of the negligence of the woman in leaving the car when she did, but the request was refused, and the supreme court thinks rightly so. It says that it was certainly competent to show any act of negligence on the part of the defendant that produced a condition apparently dangerous to passengers; and, if the conductor abandoned the car because of his incompentency to deal with the condition then existing, or because of his inexperience, it was matter for the jury to consider in determining whether the defendant was negligent in the operation of that particular car at the time. The degree of care demanded by the law in cases of this kind requires the employment of men of experience and competency, and a failure in this respect is negligence. Electricity is a dangerous agent, and its use must be attended with the highest degree of care and skill. But, notwithstanding this, there may be an appearance of great danger, when in fact there is no danger at all. It may be negligence, therefore, to place in charge of a car a person whose experience and competency are so limited that he does not know whether the danger is real or only apparent. If an experienced and competent conductor would have understood the real condition when the fire appeared, and, exercising the care required by law, would have remained in the car, and so far as possible would have prevented the departure therefrom of the woman, the evidence complained of was competent on the question of the defendant's negligence in operating the car with that conductor in charge of it.

ACCEPTING FRANCHISE CARRIES WITH IT ACCEPTANCE OF CONDITIONS IMPOSED—REASONABLENESS OF CITY ORDINANCE AS TO SPEED—ADMISSIBILITY OF TESTIMONY AS TO WHAT MOTORMAN SAID ABOUT CAUSE OF ACCIDENT—CHANGE BY COURTS WITH REFERENCE TO TREATMENT OF QUESTION OF CONTRIBUTORY NEGLIGENCE.

Cincinnati, Lawrenceburg & Aurora Electric Street Railroad Co. vs. Stahle (Ind. App.), 76 N. E. Rep. 551. Dec 14, 1905.

A franchise ordinance provided that no car should be run upon any street, between crossings, at a higher rate of speed than six miles an hour, nor over crossings at a higher rate than four miles an hour, and that a gong or other proper signal should be sounded constantly on cars approaching crossings, from 100 ft. thereof. The appellate court of Indiana, division No. 2, says that the acceptance of the privileges conferred by the ordinance carried with it the acceptance of the burdens imposed. One who takes the benefits secured to him by contract cannot refuse to comply with the obligations imposed upon him thereby. The street car company which seeks a franchise may accept the one granted or not, as it chooses, but, accepting it, takes subject to the conditions imposed.

The reasonableness of a city ordinance, aside from contract relation to it, depends upon varying conditions, and, inasmuch as the primary duty of society is to protect the individual who has, by becoming a party to the social compact, deprived himself of the right of self-protection by the strong arm, an ordinance enacted in the discharge of such duty, so imposed, by municipalities whose officers are familiar with the conditions existing, will not be interfered with by the courts, except for good cause shown, and a limitation put upon the speed of heavy cars run over city streets, such as contained in the contract ordinance stated, is very far from being unreasonable upon its face, or void.

Three witnesses testified that immediately after the collision in this case the motorman stated to the conductor that on account of the wet rail the brakes failed him and caused the accident. The admissibility of the evidence depended upon whether the statement was a natural emanation from the occurrence, made spontaneously and so nearly contemporaneous as to be in the prescence of the occurrence and under such circumstances as to exclude the idea of design or deliberation. If it was so made, it was a part of the occurrence and admissible; if it was only a narrative of a past transaction, it was hearsay and inadmissible.

The dispositon of the courts of this and other states, in which the system of electric transportation is most advanced, in the infancy of such enterprises, was to review verdicts involving the question of contributory negligence on the part of a traveler injured by collision with them as though it were a matter of law, and to set up absolute standards by which the conduct of such persons should in all events be gaged. The effect of such course of decision was to create great uncertainty and to a large degree transferred the functions of the trial court to the appellate tribunal. No absolute standard can be declared which is not inaccurate, when considered in connection with varying circumstances and facts of other cases, possessing in one or more respects a mere similarity. The result has been that arbitrary standards are no longer applied, but the question is submitted as a matter of fact under the instructions of the court, to the trial jury, whose conclusion is given that weight and consideration to which it is entitled under our system of jurisprudence.

LIABILITY FOR VIOLENT EXPLOSIONS UNDER CARS ON FOURTH OF JULY—NOT AN INSURER AGAINST ACCIDENTS—NEGLIGENCE OF EMPLOYES NECESSARY—WRONGFUL ACT OF STRANGER.

Bevard vs. Lincoln Traction Co. (Neb.), 105 N. W. Rep. 635. Nov. 11, 1905.

In order to render a street railway company liable for injuries received by a person traveling upon one of its cars, the supreme court of Nebraska holds that the negligence of its servants, either alone or in concurrence with the negligence or wrongful act of other persons, must be the proximate cause of the injuries. The wrongful

act of a stranger is not sufficient to make it liable, unless it might reasonably have been foreseen and guarded against by the carrier.

In this case, a violent explosion occurred on the track under an open car at about 10 o'clock at night, on July 4th. The smoke and flame came up around the seat on which a woman sat, and around a trapdoor just back of the seat. She was greatly frightened, and, she testified, jumped to her feet, the next thing she knew being that she was upon the pavement. In discussing the case, the supreme court commissioner says that if the defendant had, in the exercise of the greatest care, reasonable grounds to believe that violent explosions would occur such as were liable to frighten its passengers to such a degree that under the influence of a temporary loss of self-control thus caused the operation of the car might cause them injury, it would be negligence upon the part of the company to omit to take all reasonable precautions to protect its passengers against the probability of such injury. The carrier, however, is not an insurer against accidents, and while it is liable for the concurrent negligence of its servants and third parties, or the negligence of its servants in combinations with the torts of third parties which result in personal injuries to passengers, yet it is only liable when its servants have been guilty of negligence. The element of negligence on its part or on the part of its servants must exist. The wrongful act of a third party alone is not sufficient to make it liable.

If the fact that an explosion of the violence of that which frightened the plaintiff could reasonably have been foreseen by the carrier as one of the incidents liable to occur during her transportation, it would have been guilty of negligence in failing to protect her against liability to suffer any personal injuries of which it might be the proximate cause, but so far as the evidence showed such explosions as had occurred during the day, though annoying, were petty in their nature compared to this, and not such as might reasonably cause the carrier to anticipate one of such great violence. Even against such petty explosions, however, the evidence showed that the carrier had appealed for police protection, and that from the number of miles of track which it was operating it was impossible for it to procure men enough to patrol the same. The plaintiff asserted that the defendant by the use of sweeps extending in front of each truck, might have removed explosives from the rail, but the evidence showed that it would take from two to three hours to equip each car with sweeps, and that in the summer time their use produced such a cloud of dust as to make it almost impossible to carry passengers. So far as the evidence showed, an explosion of the violence of the one complained of was unprecedented in the operation of the defendant's railway, and it had no reasonable grounds to anticipate the occurrence of the same. The act was the wrongful act of third parties, over whom it had no control, and whose operations it could not reasonably foresee. Under these circumstances no reason can be seen for holding the defendant liable for the plaintiff's injuries.

LEGISLATURE NOT PREVENTED FROM GRANTING CHARTERS BY PROVISION OF CONSTITUTION REQUIRING CONSENT OF LOCAL AUTHORITIES—FRANCHISE PROVISION FOR 5-CENT FARE SUBJECT TO CONSTITUTIONAL RESERVATION—EFFECT OF CONSOLIDATION OR ACCEPTING NEW PRIVILEGES—FARES CANNOT BE REDUCED TO CONFISCATORY AMOUNT—HALF FARES FOR SCHOOL CHILDREN.

San Antonio Traction Co. vs. Altgelt (U. S.), 26 S. C. Rep. 261. Jan. 22, 1906.

By article 10, section 7, of the constitution of Texas of 1876 it was provided that "no law shall be passed by the legislature granting the right to construct and operate a street railway within any city, town, or village, or upon any public highway, without first acquiring the consent of the local authorities having control of the street or highway proposed to be occupied by said railway." The supreme court of the United States says that it was insisted in this case that under this provision the power to grant to street railways the property rights and franchises to construct and operate a street railway within a city was withdrawn from the legislature, and conferred, if not by express words, then by necessary implication, upon the municipal authorities. But this court does not so read the section. It merely provides that no such law shall be passed by the legislature, granting the right to construct and operate a street railway, without first acquiring the consent of the local authorities. The court sees nothing to prevent the legislature from chartering a street railway, provided such consent be acquired. But whether an act of the legislature be necessary to charter a street railway was not involved in this case, as the court was cited only to the original charter of the San Antonio Street Railway Co. of 1874; although it is clear that a new charter would be inoperative to authorize the construction of the road without the consent of the municipal authorities.

Assuming, but not deciding, that the ordinance of March 16, 1899, extending the franchise of the San Antonio Street Ry., and imposing certain limitations, constituted a contract pro tanto [to that extent] the question still remained whether the provision "that said street railway companies shall charge 5 cents fare for one continuous ride over any one of their lines, with one transfer to or from either line to the other," constituted a contract with respect to which no further legislation upon that subject could be enacted without impairing its obligation. Even if construed as a contract, it was still subject to the provision of the constitution of 1876, which, in section 17 of the bill of rights, declared that no irrevocable or uncontrollable grant of special privileges or immunities should be made; but that all privileges granted by the legislature or created under its authority shall be subject to the control thereof.

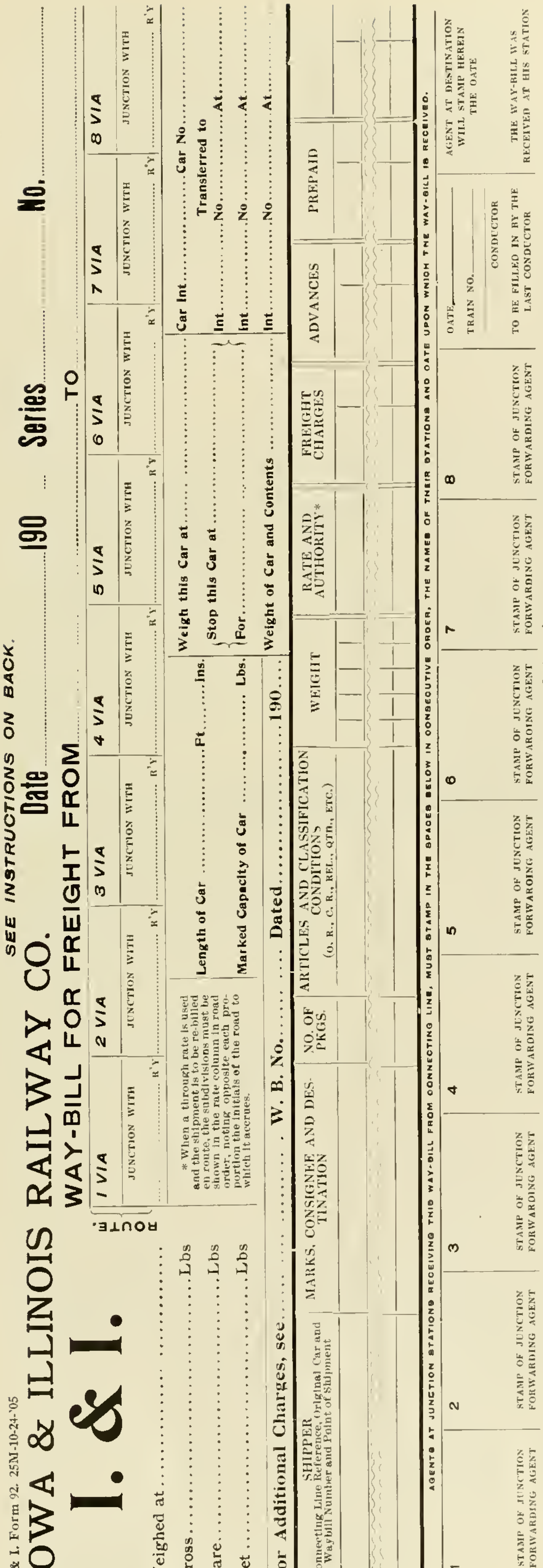
An important consideration in this connection was that the alleged contract was made twenty-three years after the constitution of 1876 was adopted, declaring that all privileges granted by the legislature shall be subjected to its control. Clearly, it was not deprived of that control by the fact that the contract was not entered into by the legislature itself, but by a municipal corporation, since that is but an agency of the state, to which is delegated the power to regulate street railways and other municipal franchises. This court has repeatedly held that where a railway was originally chartered before a new constitution took effect (and hence such charter was not limited thereby), yet, if such road be subsequently consolidated with other roads, or accepts new privileges, after a new constitution takes effect, all contracts, privileges, and franchises conferred after the adoption of such constitution are subject to its provisions.

In this case not only did the original San Antonio Street Railway Co. become extinct by a foreclosure and sale of its property, but, under an ordinance of August 7, 1900, declaring the prior companies to be "now defunct," the traction company also became the owner of all the property, assets, rights, and privileges of another company, known as the San Antonio Edison Co., which thus became absorbed with the street railway company in the new corporation known as the traction company, which was admitted to have been incorporated since 1876. The court is clearly of the opinion that, under these circumstances, it received its franchise under the constitution of 1876, which forbade either the legislature or the municipal authorities to make any irrevocable contract.

It was true that in this ordinance it was provided that all rights and privileges previously granted to the street railway company and the Edison company were conferred unto the traction company, including all the limitations, contracts, and obligations; but this ordinance must be construed in connection with the constitution of 1876, which made all such privileges and franchises subject to the control thereof.

Under the bill of rights of that constitution, the legislature could not reduce the fares to a confiscatory amount, or to an amount which would render it unprofitable to operate the road. But there was no allegation of that kind in this case, and no evidence that the reduction of the school tickets under the act of 1903 would seriously impair its revenues. Wherefore, the court affirms a judgment requiring the issuance of half-fare tickets thereunder.

Ramona Park, which is owned by the Grand Rapids Railway Co., Grand Rapids, Mich., will be opened on May 19th with a number of improvements and new features. Extensive changes have been made at the park and others are in prospect.


I. & I. Form 92. 25M-10-24-'05
IOWA & ILLINOIS RAILWAY CO. SEE INSTRUCTIONS ON BACK.
I. & I. WAY-BILL FOR FREIGHT FROM .... TO .... Date .... 190 .... Series .... No. ....
ROUTE. 1 VIA ... 8 VIA — JUNCTION WITH .... R'Y
Weighed at .... Gross .... Lbs. Tare .... Lbs. Net .... Lbs.
* When a through rate is used and the shipment is to be re-billed en route, the subdivisions must be shown in the rate column in road order, noting opposite each proportion the initials of the road to which it accrues.
Length of Car .... Ft. .... Ins. Marked Capacity of Car .... Lbs.
Weigh this Car at .... Car Int. .... Car No. ....
Stop this Car at .... Int. .... Transferred to No. .... At ....
For .... Int. .... No. .... At ....
Weight of Car and Contents .... Int. .... No. .... At ....
For Additional Charges, see .... W. B. No. .... Dated .... 190 ....

SHIPPER Connecting Line Reference, Original Car and Waybill Number and Point of Shipment	MARKS, CONSIGNEE AND DESTINATION	NO. OF PKGS.	ARTICLES AND CLASSIFICATION CONDITIONS (O. R., C. R., REL., QTR., ETC.)	WEIGHT	RATE AND AUTHORITY*	FREIGHT CHARGES	ADVANCES	PREPAID

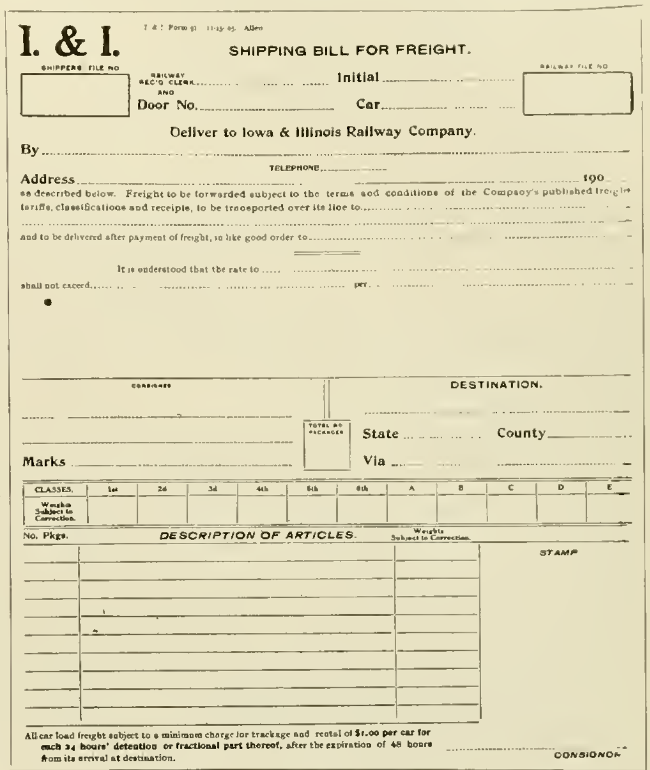
AGENTS AT JUNCTION STATIONS RECEIVING THIS WAY-BILL FROM CONNECTING LINE, MUST STAMP IN THE SPACES BELOW IN CONSECUTIVE ORDER, THE NAMES OF THEIR STATIONS AND DATE UPON WHICH THE WAY-BILL IS RECEIVED.

1	2	3	4	5	6	7	8	DATE / TRAIN NO. / CONDUCTOR	AGENT AT DESTINATION WILL STAMP HEREIN THE DATE
STAMP OF JUNCTION FORWARDING AGENT	STAMP OF JUNCTION FORWARDING AGENT	STAMP OF JUNCTION FORWARDING AGENT	STAMP OF JUNCTION FORWARDING AGENT	STAMP OF JUNCTION FORWARDING AGENT	STAMP OF JUNCTION FORWARDING AGENT	STAMP OF JUNCTION FORWARDING AGENT	STAMP OF JUNCTION FORWARDING AGENT	TO BE FILLED IN BY THE LAST CONDUCTOR	THE WAY-BILL WAS RECEIVED AT HIS STATION

FORM 2. WAY-BILL. (ORIGINAL 14x8¼ IN.)

Freight Traffic Forms of the Iowa & Illinois Railway Co.

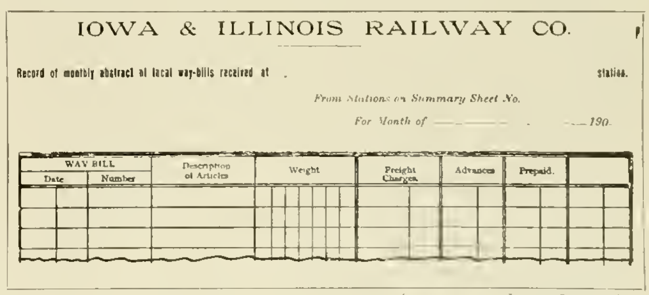
The essential object which it is desired to obtain by the use of any set of blank forms for handling the freight traffic of a railroad, is to provide a system that will permit of checking by simple methods from end to end, and also offer a basis for a clear and concise report of the business handled in the different offices using this set of blank forms. As a means of providing such desirable features P. P. Crafts, general manager of the Iowa & Illinois Rail-


I. & I. SHIPPING BILL FOR FREIGHT.
Deliver to Iowa & Illinois Railway Company.
By .... Address .... 190 ..
DESTINATION. State .... County .... Marks .... Via ....
No. Pkgs. DESCRIPTION OF ARTICLES. STAMP
All car load freight subject to a minimum charge for trackage and rental of $1.00 per car for each 24 hours' detention or fractional part thereof, after the expiration of 48 hours from its arrival at destination. CONSIGNOR

FORM 1. SHIPPING BILL FOR FREIGHT. (ORIGINAL 7¾x10 IN.)

way Co., has, after a thorough study of various systems, introduced the use of a set of blank forms, which we are pleased to present herewith.

The Iowa & Illinois Railway Co. is an especially well-built, high-speed interurban line connecting Clinton and Davenport, Ia. The roadway closely parallels the Mississippi River for its entire length of 36 miles. The physical features of this property and its general


IOWA & ILLINOIS RAILWAY CO.
Record of monthly abstract of local way-bills received at .... station.
From Stations on Summary Sheet No. ....
For Month of .... 190 ..

WAY BILL Date	WAY BILL Number	Description of Articles	Weight	Freight Charges	Advances	Prepaid

FORM 3. MONTHLY FREIGHT ABSTRACTS. (ORIGINAL 9½x14¼ IN.)

operating methods were described and illustrated in the "Street Railway Review" for Feb. 15, 1905, page 71.

Soon after operation started, a freight service was inaugurated and during the past year the substantial growth of this traffic has shown the advisability of such a measure.

Form 1, as illustrated, is the standard shipping bill. These bills and shipper's receipts of the same size are made in books so that by the use of carbon paper the written matter on the shipping bill appears in duplicate on the receipt. A supply of these books is furnished the larger customers of the freight service so that to facilitate matters they may make out the shipping bills at their

own offices and deliver them to the company. The shipper's receipt has printed on its face in the space corresponding to the blank middle portion of the shipping bill, the contract between the company and the consignor. With the exception of this the two forms are identical. The filling out of the shipping bill with the use of carbon paper transferring the writing to the receipt is all done in one operation. Form 1 after being signed by the consignor is held by the company and a duplicate of Form 1, except for the addition of the contract, is signed by the agent and given the consignor as his receipt from the company for the shipment.

Form 2 is the way-bill which the clerk makes out for the various shipments to each destination and forwarded with shipments. On the back of this form are the following instructions to conductors:

1. Conductors and others handling this way-bill must see that all information required to be furnished enroute is entered in the space provided therefor.

2. Way-bills regularly numbered must accompany all freight received from agents.

3. Car initials and numbers must be entered on way-bills at the time freight is loaded into passing trains.

(SINGLE SHIPMENT.)

Receipt for Prepaid Freight Charges Collected at

FROM

consignor. To apply to prepayment of charges on freight consigned to

Consignee

At

W.-B. No. ______ Dated ______ 190

Car Initials ______ Car No. ______

Capacity of Car ______ Pounds.

Consignor Dr. to IOWA & ILLINOIS RAILWAY COMPANY.

DESCRIPTION OF ARTICLES.	WEIGHT	Rate	Amount Prepaid.

NOTE.—The signature and date must not be filled in until after the receipt is detached and the charges are paid. The initials and surname of Agent must be given.

Total to Collect

Book 1

No. 500

Received payment ______ Agent ______ 190__

FORM 4. RECEIPT FOR FREIGHT CHARGES. (ORIGINAL 11x3½ IN.)

FREIGHT BILL. RECEIPT FOR CHARGES ON FREIGHT

At

From

Consignor

Consignee

Way Bill Series and No. | Way Bill dated ______ 190

Car No.

Capacity of Car ______ lbs | Date of arrival at Destination ______ 190

Original Point of Shipment | Connecting Line W. B. Reference

CONSIGNEE, to IOWA & ILLINOIS RAILWAY COMPANY Dr.,

No. of Pkgs.	For Charges on the following Articles	Weight	Rate	Freight Charges	Advances	Prepaid	Amount to be Coll'd of Consignee

NOTE.—This form is intended to cover the billing charges in those embraced on the way-bill made by the forwarding agent and no other form of receipt is valid for such purpose or is binding upon the company.

Received payment ______ Agent ______ 190__

All carloads shall be subject to a minimum charge for trackage and rental of $1.00 per car for each 24 hours detention, or fractional part thereof after the expiration of 48 hours from arrival at destination.

Original Paid Freight Bills should accompany all Claims for Overcharge, Loss or Damage

BOOK 12

RECEIPT No. 998

The undersigned hereby acknowledges to have received of the Iowa & Illinois Railway Co., in good order, the property described in its freight bill and record of freight received bearing the same numbers respectively as those printed hereon

Amount Charges Paid, $ ______

______ Consignee

______ 190__

BOOK 12

RECEIPT No. 998

FORM 5. EXPENSE BILL. (ORIGINAL 17½x2¾ IN.)

.... Station, ... 190......

Dr. **CASH RECEIPTS.**

DATE OF WAY-BILL.	Way-Bill No.	Book No.	Freight Bill No.	STATION FROM OR TO	NAME.	WAY-BILLS. Total Charges Collected on Freight Received.	Total Prepaid Collected on Freight Forwarded	Miscellaneous Collections (not included on Way-Bills).	Total Charges Collected on Excess Baggage, Bicycles and Baby Cabs	TICKET SALES.	TOTAL.

FORM 6. PAGE FROM CASH BOOK. (ORIGINAL 10x15¼ IN.)

I. & I. Form 106. 8-8-'05 500 Allen

Record of and Receipt for Advanced Charges, at .... Station.

Consignor	Consignee	Description of Articles	Way-billed to	Date of way-bill month	day	year	Way bill Number	Amount advanced	Date of Payment month	day	year	We hereby acknowledge to have received from the Iowa & Illinois Railway Co. the amount set opposite our respective names

FORM 7. RECORD OF AND RECEIPT FOR ADVANCE CHARGES. (ORIGINAL 13¾x8 IN.)

I. & I. Form 107 [illegible] Allen

RECORD OF OVER-PREPAID CHARGES ON FREIGHT RECEIVED at .... Station and Disposition Made of Same.

Date way bill was received	Book and Receipt number	Station from which freight was billed	Way bill number	Date of way bill	Name and Address of Shipper	Consignee and Destination	Amount prepaid	Amount required	Amount over prepaid	Am'ts paid during the Mo. of ___ 190	Am'ts unpaid at close of the Mo. of ___ 190	Am'ts paid during the Mo. of ___ 190	Am't reported as [illegible] 190	Number of Draft	Date of Payment	We hereby acknowledge to have received from the Iowa & Illinois Railway Co. the amount set opposite our respective names

FORM 8. RECORD OF OVER PAID CHARGES. (ORIGINAL 16x8 IN.)

4. Way-bills must not be changed unless authorized in writing by an official or the forwarding agent. When a change is made the authority therefor must be securely attached to the way-bill.

5. Freight must be weighed at the station designated unless instructed in writing to weigh at some other station, by an official of the company. The authority for making the change must be securely attached to the way-bill.

6. Way-bills must accompany freight. If freight is left short of its destination or end of run, way-bills must also be left, unless there is no agent, when they must be left at the first regular station and the division superintendent notified by wire.

Form 101.

RECEIPT FOR MISCELLANEOUS COLLECTIONS. No 99

IOWA & ILLINOIS RAILWAY CO.

Station .... 190.....
(Name of month must be written.)

This is to Certify that I have received
from .... of ....
the sum of .... Dollars. $ ....
for ....

On account of freight hauled in car No .... Way-bill No .... dated .... 190.....
From .... station to .... station
Received payment .... Agent.
.... 190...

NOTE.—This form must be used in all cases where specific forms, such as a freight bill, receipt for prepaid freight charges, receipt for switching charges, etc., are not provided. It must be used in all other cases and no other form of receipt is valid or binding upon the company. The information that this blank is intended to give must be entered in detail in every case by the person making the collection. The receipt must be signed before being detached from the book.

FORM 9. AGENT'S RECEIPT FOR MISCELLANEOUS COLLECTIONS. (ORIGINAL 8½x4 IN.)

500. 8-11-05

Iowa & Illinois Railway Co.

.... *STATION,* *190*

The following property consigned to you from
has arrived at this depot, and is now ready for delivery:

CAR	ARTICLES	CHARGES

Which is now at your risk. Please call, pay charges and remove property WITHIN 24 HOURS, or same will be charged storage or delivered to Warehouseman.

All car-load freight shall be subject to a minimum charge for trackage and rental of $1.00 per car for each 24 hours' detention or fractional part thereof, after the expiration of 48 hours from its arrival at destination.

AGENT

Deliver to

N. B.—Property delivered only to consignee or order. If not personally known to Agent, bring with you the original receipt or bill of lading issued at shipping point to identify you.

CONSIGNEE

FORM 10. ANNOUNCEMENT OF FREIGHT RECEIVED FOR CONSIGNEE. (ORIGINAL 5½x3¼ IN.)

7. Freight must not be delivered at points where there are no agents unless the charges as shown by way-bills are fully prepaid.

8. Receipts must be taken on the way-bills from consignees or their agents for all freight delivered at points where there are no agents. The way-bills must then be left at the station. Press copies of the way-bill are taken to act as checks on shipments and deliveries.

A record of every shipment forwarded during the month from a station is made on Form 3, called a "Monthly Abstract." These forms are bound in a book. The pages of this book are printed alternately in red and black ink with the red printed page perforated near the binding so that when the record of shipments for the month is complete the red pages can be torn out and sent to the freight auditor. A sheet of carbon paper is used for obtaining duplicate monthly abstracts. A similar book is kept for each station except that the second book is a monthly record of the shipments received at the station. By the use of these records the auditing department can check the way-bills, shipping receipts, expense bills and credit side of the cash book for the month. These abstracts are also a handy indication of the amount of business for one month done by the station where they are made out.

When a shipper prepays a consignment of goods he is given a receipt as shown in Form 4. These receipts, five in number, are made into pages of a book. The book also includes a set of pages alternating with these receipt pages, but with the "weight," "rate," "prepaid" and "collect" columns ruled from the top to the bottom of the page. With this arrangement of alternating pages and the use of carbon paper, a copy of each receipt given by the agent remains bound in a book in a suitable form for obtaining totals.

Form 5 is the expense bill used when collecting charges from a consignee. Five of these forms are made up as a page of a large book which also has as its alternate leaves a blank form for receiving by means of a carbon impression, a copy of the expense bill.

Each station has a cash book the receipt side of which is shown as Form 6. The disbursement side, on the opposite page, is similarly arranged and the entries for these two pages are kept up with the other business of the office.

A delivery ticket is made out at the receiving office and when a shipment is handed over to a drayman, he signs this ticket and thus frees the company of any errors of delivery. On this ticket are noted the number and weight of the articles given the drayman, names of consignor and consignee, car number and initials and the dates of shipment and delivery.

Form 7 is a page from the book used as a record of and receipts for advance charges paid at the station keeping the book.

For advising an agent of corrections to way-bills a railway business mailing card is used. When errors are found by a receiving agent he makes the corrections and notifies the shipping agent with one of these cards.

A record of overpaid freight charges is kept in a book the pages of which are ruled as shown on Form 8.

Form 9 is a receipt for miscellaneous collections made by a station agent. A number of such forms with blanks for receiving carbon duplicates are bound in a suitable book.

Form 10 is the reverse side of a United States postal card which is used in notifying a consignee that a shipment of goods is awaiting him at the receiving station.

By the use of these forms a very complete control is had of the freight traffic of the Iowa & Illinois Railway Co. At the end of each month a report is made out for the tonnage and receipts of each of the several stations on the line, which reports, when presented in a comparative form, furnish an excellent method of comparing the freight business of the several stations and also for obtaining the percentage of freight business in comparison with the total business of the company.

April Meeting of the New England Street Railway Club.

"Fuel and Boiler Furnaces" was the topic before the last meeting of the New England Street Railway Club, which was held at the American House, Boston, on the evening of April 26th. President Paul Winsor was in the chair and the speaker of the evening was Mr. John S. Schumaker, of the Farrel Foundry Co., Ansonia, Conn.

Mr. Schumaker pointed out the need of a fuller consideration of the subject of boiler furnace design and the handling of fuel and stated that the important point is the number of heat units which can be utilized in the furnace per dollar paid, instead of the number of heat units which a pound of the fuel originally contains. This heat utilized, does not depend entirely upon the number of units in the fuel. Heat concessions have been made in the design of certain modern boilers in order to enable a furnace temperature of 3,000° F. to be maintained.

When a shovelful of soft coal is thrown upon a bed of hot fuel in the average furnace, some of the volatile matter is actually distilled before the coal has landed and if the atoms of hydrogen and carbon thus distilled do not find their quota of oxygen, there is small chance that they will do so while within the control of the engineer.

Flaming should cease before any extraction of heat by the boiler proper takes place. This may be difficult to attain, but much may be accomplished by reducing the velocity of the gases through the boiler. Flame in the last pass of the gases in a water-tube boiler is in no sense beneficial. It is the result of burning soft coal with too much draft. Inefficiency is bound to result from any attempt to use the tubes of a fire tube or the tube space of a water-tube boiler as a combustion chamber. It is a cardinal principle that combustion and the transmission of heat cannot go on at the same time and place with economy. The 100 per cent or even 150 per cent of air in excess of that required to effect the combustion of the fuel is not to make up for the lack of even distribution of oxygen in the furnace, but is to act as a heat insulation up in the fire tubes and tube space, to permit combustion to proceed. When the bulk of the gases is discharged into the tubes and tube spaces, something

must come between them and the cold tubes or combustion will never be completed This is why soft coal, with about 20 per cent or more of volatile matter, is not a desirable fuel for many of the tubular boilers and some of the water-tube boilers now on the market. In some of these types of boilers, both time and space for combustion are at a minimum. Here hard coal is the most desirable from the standpoint of heat economy. With hard coal, there are no large quantities of combustible gases to be quickly distilled and swept into the heating spaces of the boiler before sufficient time has elapsed for combustion to take place.

The percentage of moisture in fuel is of much importance. Mr. Schumaker cited a case where in changing from a coal containing 6.15 per cent of ash to one containing 5.23 per cent of ash, the per cent of moisture increased from 1.28 to 3.62. Ash is not the only point to be considered, for, as this case showed, there was an increase of 2.34 per cent in moisture exacted as the price of a decrease of only 0.92 per cent of ash. The ash is inert, but the moisture takes away with it the heat units necessary to evaporate it and it has about double the specific heat of hydrogen as well. Moisture also makes it necessary to increase the velocity of the gases through the boiler, and the practice of wetting the fuel before firing is most objectionable.

Some types of down draft furnace have not given the results desired because the furnaces have been inadequate, being little more than places to poke coal into. The remedy, more air, has been almost as bad as the disease. "In the type of water tube boiler so frequently installed," said Mr. Schumaker, "in which the gases from the so-called furnace rise directly into the tube space, the boiler itself is very nicely designed, but the furnace is inadequate." The ample brick arch furnace is of no great benefit because the velocity of the gases through it is so high that the time necessary for proper combustion is not permitted.

Draft determines the velocity of the gases through the boiler Draft is necessary to move the products of combustion and, in the average boiler furnace, such other products as the furnace delivers, through the boiler, overcoming resistance that is fixed for each plant, except in one factor. The variable factor is the thickness of the bed of fuel on the grates. The thinner this is, the less resistance will it offer. This is the most important resistance to be overcome. The draft is made strong enough to pass 200 per cent of the air necessary for combustion, through the fuel. With induced draft, either by fan or chimney, the draft is arranged to be ample for the heaviest bed of fuel which will probably be carried. This means that just above the fuel, with a bed 12 in. to 14 in thick, there will be a vacuum equal to .75 in. to 1 in. of water, with a total draft of from 1 in. to 1.5 in. of water As soon as the fire doors are opened to add fuel, there is a strong inrush of air, and with a flat, hand fired grate, natural draft does not help reduce the velocity of the gases through the furnace and boiler

Mr. Schumaker criticised the use of the steam jet draft as very unfavorable to economy. In no case can the steam give up more heat by association than it has taken for its dissociation, and in any case the cycle must be effected through the furnace, which means a net loss in efficiency. To the gases normally voided by the chimney, must be added a weight of gas equal to from 3½ to 12 per cent of the steam output that being the amount of steam necessary to maintain the draft. The most efficient steam jet draft which Mr. Schumaker has tested took 8.7 per cent to maintain a .95 in. draft. The steam leaves the furnace as a gas, carrying very high specific heat. The steam jet draft is also hard on the furnace, for the reason that it causes abrupt and local temperature changes; the draft is all on or all off, and in one case, this in three years' time, caused the tubes just over the fire in a water tube boiler to split crosswise. The use of steam also causes too high a velocity of gases through the furnace and boiler.

Ideal draft conditions can be produced by using forced draft with a fan. Combustion takes time, but the time is variable with respect to the temperature and the proportions of the mixture burned. The higher the temperature, the more quickly does combustion take place. A perfect mixture of carbonic oxide and air will require from .04 to .07 seconds to become carbonic acid upon ignition, per cubic foot of gas. Even if we effect a complete combustion in .08 seconds, this is too slow for the average boiler furnace, through which the gases are swept at a speed of from 20 to 50 ft. per second. This rate of combustion is very much reduced by the lowering of the temperature from contact with the heating surfaces, so that we find at times these gases with combustion still going on in the last pass of the boiler, due to combined high velocity and cooling effect.

With semi-bituminous coal and 100 per cent of the air necessary to combustion, the ideal temperature of combustion will be about 4,700° F.; with 150 per cent air, it falls to about 3,300° F.; with 200 per cent air, to about 2,600°; and with 250 per cent air, or 150 per cent in excess of that required (a common practice), the ideal temperature falls to about 2,100° F. It is thus very desirable to reduce the amount of air close to that theoretically required for the combustion of the fuel. The excess of air supplied frequently takes away with it 15 per cent of the heating value of the fuel.

With forced draft, the fan can be adjusted so as to give both the pressure and quantity required, expending excess energy at the top of the fuel bed. The balance of the draft will necessarily be very small, sufficient only to carry the products of the furnace through the boiler, flue, etc. This induced draft must show less than .05 in. just above the bed of the fuel. The fire doors can then be opened as frequently as necessary to add fuel and keep the bed in good condition. Leveling down of the fire is essential for an even air distribution in the furnace. The higher the furnace temperature, the greater will be the necessity of working the fire to break up the caking of the fuel. Small quantities of coal should be added frequently, and spread uniformly over the fire. The best gas mixing occurs just above the fire and the higher one goes in the furnace, the greater the tendency for gases to stratify. Mr. Schumaker gave his opinion that with the furnace and draft conditions and method of handling fires just outlined, 95 per cent of the plants can increase their efficiency from 10 to 15 per cent, while doing anywhere from 80 to 100 per cent of their rating. He stated that in his opinion, the chief difficulty with the mechanical stoker is its inability to meet the demands upon it by reason of the erratic burning of the fuel. The proper handling of the fuel cannot be accomplished by drawing up a set of rules to govern the boiler room force and then applying them indiscriminately to all plants. Spasmodic efforts at boiler room economy are not apt to prove beneficial.

Thus, in burning soft coal, the point of keeping the fuel in the furnace level may be taken up as a good one and easy to put into effect. Instructions are forthwith sent to the firemen to keep the fires as level as possible. If the bed of the fire has been from 12 to 14 in. thick the fireman soon learns that it is easier to maintain a bed of fuel 6 in. thick in a practically level condition than a bed 14 in. thick. This being so, he will drop the thickness to about 6 in., although the draft pressure is for 12 or 14 in. of fire. The result will be an air rate even higher than it was, and the charge may net nothing in added economy, or even a loss. There is certainly room for economy in operating the boilers with due regard for the load factor of the plant.

Mr. Schumaker concluded by predicting that the boiler furnace of the near future would dispense with the chimney and would be placed entirely within the boiler proper. He has already operated such a boiler under 80-lb. pressure.

Plans of the Twin City Rapid Transit Co. for the Summer Season.

The Twin City Rapid Transit Co. has recently built a fleet of nine steamers which, in connection with the company's two new electric lines, will be operated on Lake Minnetonka, to amusement resorts on the lake. There are three double-end, double-deck ferries, each 100 ft. long and having a capacity for 1,000 passengers, which will run between the terminal of the company's electric lines at Excelsior and Big Island Park, which park the company has recently established on an island in the middle of the lake. There have also been built six express steamers each 70 ft. long with a capacity for 150 passengers and a speed of 15 miles an hour. These will operate along the lake shore and pick up cottagers at various points. In addition to this equipment the company has purchased three other fast excursion steamers so that the fleet of 12 steamers will have a total carrying capacity for nearly 5,000 persons.

Three lines of sightseeing cars will be put in service by the Twin City Rapid Transit Co in the near future. These will afford rides of from three to five hours each, the trip to cost from 50 cents to one dollar. The "Twin City Sightseer" will include St. Paul and Minneapolis. The "Wildwood Sightseer" will include both cities and also Wildwood, on the White Bear Lake. The "Minnetonka Sightseer" will include both cities and Lake Minnetonka.

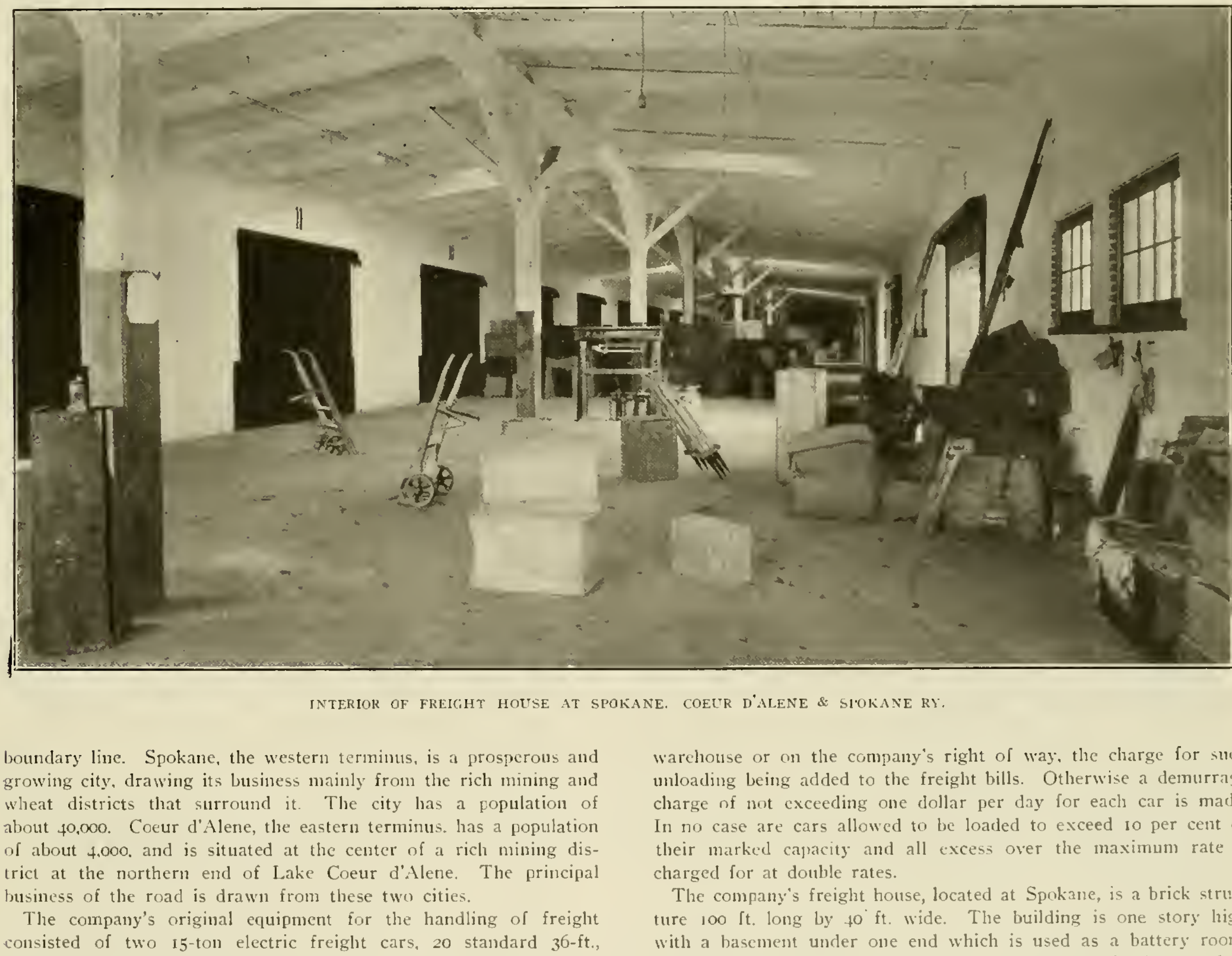
The Freight and Express Traffic of the Coeur d'Alene & Spokane Ry.

The conditions under which the interurban roads of our extreme western states operate, have made the handling of freight and express matter an item of considerable importance. In general, these lines serve territories rich in natural and manufactured products. The facilities offered by the interurban roads for quick and convenient transportation, make them the natural carriers for a considerable portion of these products. Among these western lines, that of the Coeur d'Alene & Spokane Railway Co., Ltd., enjoys a large and rapidly increasing freight and express traffic and as it is one of the representative interurban properties of this region, a description of the methods of operation of its traffic department may prove of interest.

The Coeur d'Alene & Spokane Railway Co., Ltd., a description of which was presented in the "Street Railway Review" for August, 1905, began to operate on Dec. 28, 1903. The line extends from Spokane, Wash., to Coeur d'Alene, Idaho, a distance of 34 miles. For the most part, it follows the general direction of the Spokane River and crosses the river at a point on the Washington-Idaho boundary line. Spokane, the western terminus, is a prosperous and growing city, drawing its business mainly from the rich mining and wheat districts that surround it. The city has a population of about 40,000. Coeur d'Alene, the eastern terminus, has a population of about 4,000, and is situated at the center of a rich mining district at the northern end of Lake Coeur d'Alene. The principal business of the road is drawn from these two cities.

The company's original equipment for the handling of freight consisted of two 15-ton electric freight cars, 20 standard 36-ft., 50,000-lb. flat cars, 20 standard 36-ft., 60,000-lb. box cars and two 65-ton steam locomotives. There have since been added 20, 36-ft. 60,000-lb. flat cars. Two electric freight cars are operated daily between Spokane and Coeur d'Alene and each pulls a 60,000-lb. standard box car trailer. The company has handled as high as 186,000 lb. of package freight out of Spokane in one day. At night a steam freight train of from 15 to 20 cars is operated between Spokane and Coeur d'Alene, handling logs, sawed lumber, cord wood, ties, poles, hay, mill-feed, loggers' supplies, vegetables, etc. Milk is handled into Spokane each night and morning, the cans being picked up at all stations when supplied with the proper tickets and delivered at the freight terminal in Spokane. The freight business has shown a steady increase. During the month of February just past 428 cars were handled.

In billing, handling and auditing freight, the company follows steam road practice. The rates are the same as on competing steam lines but the efficient service offered and the local interest in the enterprise have given the company a large percentage of the local business existing between its terminals. The freight traffic is governed by the Western Classification when not in conflict with the company's rules. No single shipment is carried for less than 25 cents. Household goods, personal effects and articles of a perishable nature or of a doubtful value are required to be prepaid or fully guaranteed. There are 21 way stations between Spokane and Coeur d'Alene. At these stations there are no agents and all incoming and outgoing freight is handled at these points at the owner's risk and must be prepaid. Upon the arrival of freight at either of the terminal stations, the consignee is notified by the agent, after which notification, the freight must be removed within 48 hours. At the expiration of that time a storage charge is made, varying from one cent per hundred pounds for one day to seven cents for 30 days and four cents for each additional 30 days thereafter. All carload lots must be unloaded by the consignee within 48 hours of their arrival at their destinations, after which time it is at the option of the company to unload the freight into the warehouse or on the company's right of way, the charge for such unloading being added to the freight bills. Otherwise a demurrage charge of not exceeding one dollar per day for each car is made. In no case are cars allowed to be loaded to exceed 10 per cent of their marked capacity and all excess over the maximum rate is charged for at double rates.



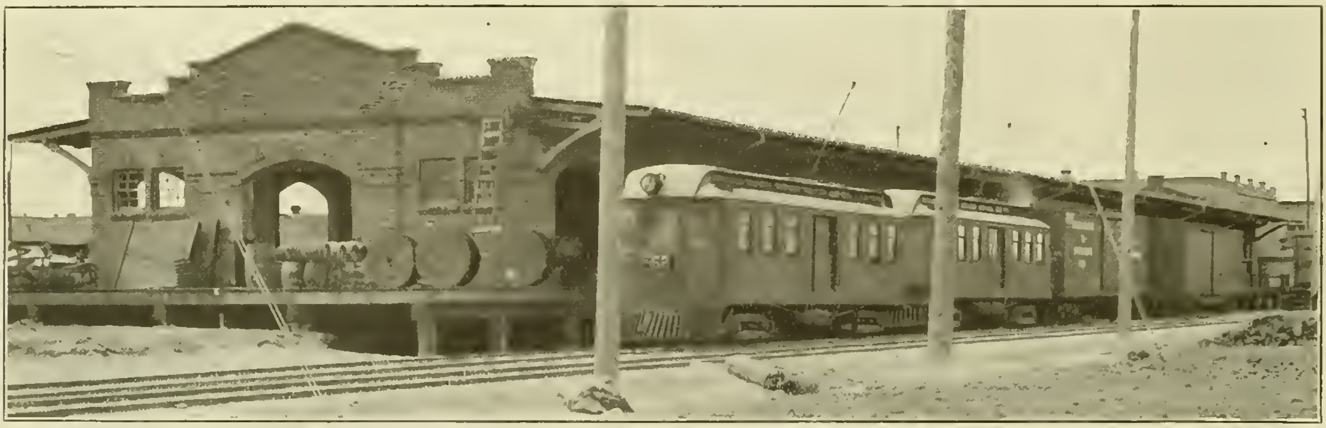
INTERIOR OF FREIGHT HOUSE AT SPOKANE. COEUR D'ALENE & SPOKANE RY.

The company's freight house, located at Spokane, is a brick structure 100 ft. long by 40 ft. wide. The building is one story high with a basement under one end which is used as a battery room. An office is located at the eastern end of the main floor and is well equipped for the transaction of all business relative to the moving of freight. There are three large platform scales spaced at regular intervals along the main floor. The freight is handled on either side of the building, there being eight doors on the north side and thirteen on the south side. The doors are equipped with fire-proof rolling shutters.

Owing to the central location of its freight terminal, the company has been in receipt of a number of applications for location and side-track privileges for various kinds of industries. The company has already located several that will afford both incoming and outgoing tonnage. The freight terminal yards, tracks and improvements are to be used jointly by the Coeur d'Alene & Spokane Ry., the Spokane & Inland Ry. and the Spokane Traction Co. The

company also has direct connection and exchanges cars with the Union Pacific, Great Northern and Northern Pacific railroads and by August 1st, it will have connection with the Canadian Pacific through the Spokane International, now building.

At Coeur d'Alene connection is had with the Coeur d'Alene & St. Joe Transportation Co., which company operates a line of steamers on Coeur d'Alene Lake and up the Coeur d'Alene and St. Joe rivers. The lake is 30 miles long and the St. Joe River, which enters at the southern end, is navigable for 40 miles farther, thus giving the company a large tributary district beyond its eastern terminus. It has been reported that the cut of lumber on the St. Joe River for the winter just past will be 100,000,000 ft. and of this it is expected that the company will handle the greater portion. The company has from the first given considerable attention to building up its freight and express business and has used personal letters to all merchants and jobbers from time to time, and also personal solicitation of all the principal shippers that could be reached.



VIEW OF FREIGHT HOUSE AND STANDARD ROLLING STOCK.

The company handles express on all of its passenger trains, receiving and delivering it at passenger stations. The express rates are about double the freight rates but are only from 50 to 60 per cent as much as those of the express company operating over the steam lines. The company is able to make this lower rate since it does not make wagon delivery at either terminal. On this basis, the company has secured the greater portion of the express business since it offers 11 trains a day each way as against one each way by its competitors. The same reasons have secured for it the handling of the newspapers and the United States mails.

The rules regarding the handling of express matter are about the same as those which apply to the handling of freight. The company has an agreement with the Pacific Transfer Co. which delivers express matter throughout Spokane at moderate charges.

The cartage rates applying on business handled by the Pacific Transfer Co., are as follows:

Freight consignments to and from depots and within a mile limit.

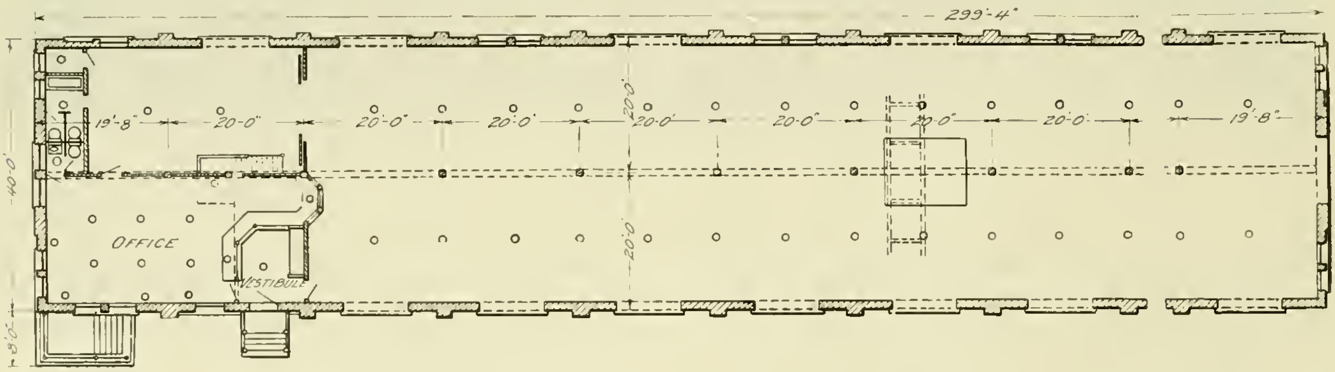
1 to 500 lb. .... 25 cents
500 lb. and over, per 100 lb. .... 5 cents
Ton lots and over, per ton .... 60 cents

Express matter and small shipments of freight that can be handled in parcel delivery wagons. To all parts of the city as follows:

5 lb. or less .... 10 cents
5 to 15 lb. .... 15 cents
15 to 60 lb. .... 25 cents
60 to 100 lb. .... 35 cents
Over 100 lb., per 100 lb. .... 35 cents

These rates do not apply on pianos, household goods, furniture, store fixtures or other bulky freight. Special rates are provided for these articles as follows: For delivery to points within the two-mile circle, $1.00 per 1,000 lb. on the ground floor; above the ground floor where there is no elevator, the charges for the delivery on the second floor are 50 cents, third floor 75 cents, and fourth floor 75 cents extra per 1,000 lb. There is also a charge of 50 cents extra per van load for each additional mile and $1.00 extra for a piano in shipments of household goods.

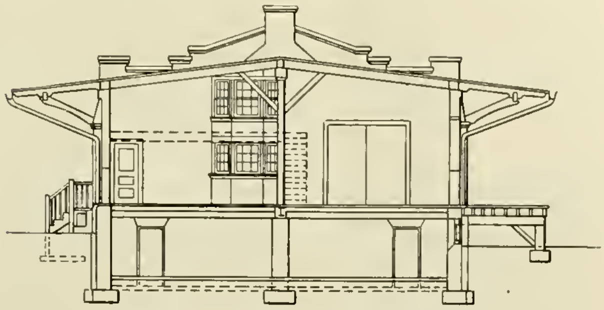
In the "Street Railway Review" for March, 1906, the incorporation at Spokane of the Inland-Empire Railway Co. was announced. This new incorporation is a merger of four companies, the Coeur d'Alene & Spokane Railway Co., the Spokane Traction Railway Co., the Spokane & Inland Railway Co. and the Spokane Terminal Co. The Spokane & Inland Railway Co. has a line partially built south of Spokane which it is expected will be finished to Waverly, a distance of 34 miles, by July 1st, and completed to Colfax and Moscow by January 1st, next.



FIRST-FLOOR PLAN OF FREIGHT HOUSE.—COEUR D'ALENE & SPOKANE RY.

On this line, single-phase current, at an operating pressure of 6,600 volts will be used. The equipment ordered, includes three 80-ton, 1,200-h. p. single-phase, Baldwin-Westinghouse locomotives, 18, 58-ft. passenger cars and six 50-ft. electric freight cars built by the J. G. Brill Co. and 60, 60,000-lb. standard flat cars and 50, 80,000-lb. standard box cars built by the American Car & Foundry

Co. This equipment will probably be largely increased during the latter part of the year as the company expects to develop a heavy freight business between Spokane and points on this branch.



END ELEVATION OF FREIGHT HOUSE.

The officers of the Coeur d'Alene & Spokane Railway Co. are F. A. Blackwell, president; R. F. Blackwell, vice-president and manager; W. G. Paine, traffic manager; C. P. Lindsley, secretary; Ira H. Shallis, auditor; William Dollar, treasurer, and J. C. White, chief engineer.

The Standard Car Body and Truck.*

BY GEO. H. TONTRUP.

The electric car, by its development, has shown itself to be the missing link between the horse car and steam coach. The horse car it has almost caused to be extinct, and at the present time, the interurban is making fast inroads into the territory of the steam coach. With these two extremes to straddle and take care of, it can be seen that it would be a difficult task to build a car that would accommodate itself to all the conditions that obtain. Hence, we must turn our attention to two classes of cars, so as to fill the necessary requirements of the ideal; one for city and the other for interurban service.

The first, in the order we will consider them, should be for city service, since it claims priority in the line of evolution through which the electric car is passing. I believe the cardinal requirements of such a car may be stated as: handling of passengers, comfort, and maintenance. Each of these can be divided, and subdivided, and taken as an individual subject for a separate paper before it would be exhausted, but in a paper under this general heading, all must be considered to a certain extent.

In the handling of passengers in densely populated districts, which condition necessitates numerous stops and running at as high a speed as the law will permit between stops, it has been proven that the principal objection to the double-truck car, in regard to the loading and unloading of passengers, is fast becoming removed. The argument advanced by some of the advocates of the single-truck cars was that less time was consumed in walking the length of the shorter car to the rear platform. This is true and would remain a strong objection to the double truck if the same oscillation, teetering and unsteady motion, when running, existed on the double truck, which is quite obvious on the single. The comparative steadiness of motion of the double-truck car, enables passengers, especially ladies and children, to leave their seats a block or a half block before arriving at the stop they desire. The same is true in starting and the conductor can give the signal to start as soon as passengers are safely on the platform.

The next to be considered under this heading is the platform. This should have but one single step and as low as the height of motor, diameter of wheel, and curvature of the track will permit. These steps should be at diagonal, opposite corners, thus obviating the chances of accident to a great extent and the annoyance of damage suits that usually follow. This platform, to further facilitate the handling of passengers, should be as long as possible, consistent with strength and the prevention of sagging. These lengths have ranged from the standard 4 ft. 8½ in. to 7 ft., but experience has shown us that on city service with cars running on flat rails, it is not safe to exceed 6 ft. and expect a rigidity that will be in keeping with the life of the car. This platform should be further provided with a rail running from the step to within, say, 24 in. of the opposite side. The benefit of such a rail in keeping passengers from surging and establishing an entrance and exit from the car is easily seen. It is needless for me to say here that this platform should have what is commonly called a three-quarter vestibule with folding doors, or gates.

The next thing in order after landing on the platform is the entrance to the body of the car. This, in my opinion, should be a single door and of the accelerator type. By the use of this door, at least three-quarters of the rear platform is available for standing passengers which allows passengers to get on and off at the same time giving the advantage in time to the passengers getting off, which is the thing most desired.

After passing into the car, the next point that attracts our attention is the aisle. Indeed, I may interrupt myself here to say, that this point, like some of the others I have mentioned, is but co-related with the comfort of passengers so that it is difficult to draw the line of demarkation. This being true we must study our car in regard to the comfort of passengers. The width of aisle is an important factor in city cars and it should be as wide when cross seats are used as a comfortable seat will allow. To go a step farther we will see that the width of aisle and length of seat are dependent on the width of car and if the condition of devil strip, curves of track and width of street are such that they will restrict the width of the car, it follows that the only place we can economize so as to give us the greatest interior or width must be the walls. To accomplish this, the sash should raise, giving a large part of the sash pocket for extra or increased aisle width. This construction has another advantage—that of being more sanitary, and not only adds to the comfort of many passengers, but also eliminates a refuse receptacle for others.

The seats for this car should be transverse, with corner grab handles, except at the ends of the car, which should have at the narrow side of the door, a longitudinal seat, and a stationary end seat which will seat three passengers at the wide side of the door. This arrangement will give a greater standing space at the doorway in which portion of the car it is most needed. The ventilators should be hinged in pairs, so that one-half or less may be opened in the opposite direction to that in which the car is moving. This method creates a suction from the inside of the car and at the same time excludes all dust, which is the correct means of ventilation.

How to heat this car is certainly a question that comes under this heading. The manufacturers of car radiators have succeeded in producing many good types, both in stoves, hot water, hot air and electricity, and any of these would produce all the heat necessary to maintain a comfortable warmth if it were not wasted. Therefore, the question is not so much how to heat the car as it is to keep or save the heat generated. This is governed very largely by climatic conditions, the attention to duty by the conductor and partly by the construction of car, so we will take care of the construction of the car as far as possible and leave the conductor and climate to our friends, the operating managers.

As to the lighting of the car, this is largely a matter of equal distribution and placing the lamps in a vertical position, for when the lamps are placed on the walls of the car, or in a horizontal position, they not only produce a quivering light, but the films are very much impaired by the vibration of the car.

The next heading under which we are to consider the car will be that of maintenance, and I wish to say here that the reduction in cost of maintenance is largely dependent on the first cost. The car of which I have been endeavoring to make a mental picture, is of the double-truck type and in view of the fact that an electric car is continually subjected, when running, to an earthquake condition, it is essential from a standpoint of maintenance, that those frequent shocks should be reduced to a minimum by the use of good trucks. Although it is of paramount importance, I confess that I have little to say about it. For it must be said about this piece of machinery that which is true of all other pieces, paradoxical as it may seem, that the least you buy for the money, the more you get. In other words, the fewer pieces that our truck consists of the easier it is to keep in repair and only those parts are necessary that will keep the frame true and square, take care of the brake rigging, and be resilient. The use of hot rivets, in many cases, is

*Read before the Iowa Street & Interurban Railway Association, Des Moines, April 20, 1906.

not a good practice. Not only are they troublesome when repairs are needed but they cause the structure to work when long pieces of dissimilar metals are riveted together, owing to the difference in contraction and expansion of such metals.

In regard to the resilience, that truck is best that will dissipate a shock or jar to a minimum, caused by the wheels going over depressions in rails, before it reaches the body center plate. This calls for a sufficient number of nests of springs and an exact distribution of them. While these springs have for many years, been arranged and rearranged in every conceivable manner, it has been proven beyond question, that the springs carrying the equalizer when brought as close as possible to the oil box or journal, which is the first place the impact is felt, offers the correct idea of killing the shock and goes the farthest in reducing its effect on the car body.

There is one construction feature of the city car body that lost its usefulness a long time ago and has about served its purpose as an ornament. I refer to the concave and convex panels. These are ear-marks of the omnibus, and serve their purpose of mud guards and give the greatest width of car body over the wheels. The car builder and operator have been slow to abolish these features, believing that they add to the beauty of the car. I believe all will agree that the straight side is not only the strongest car but the easiest to maintain. In case of damage, it requires but the replacement of a few pieces of sheathing instead of a long panel as must be furnished when the car is of paneled side. The panels on the concave car have always been a very troublesome and uncertain part of the structure, both to the car builder and operator. And now we find a few companies have adopted a steel sheet covering for the panels. The car builders, I assure you, have taken every care to use the best seasoned lumber and to have the most skilled workmen in their employ put on those panels, and notwithstanding this, there is still an uncertainty whether the panels will stand and live through the extreme changes of temperature, particularly in the spring and fall seasons.

The most essential thing in regard to the maintenance of cars falls to the lot of the operator, and I must say here, that it is the most neglected. I refer to the tightening of bolts and nuts. The car is often run for months without taking up the slack on nuts. The nut on a bolt should be tightened as much as possible with a wrench, and then the head of the bolt should be given a sharp tap with a hammer. It will be found that the nut will then stand another turn or half turn. If this tightening is neglected, the whole structure will soon begin to work in all its parts and will soon need a general overhauling. There are many other points that can be brought out under this heading, but those mentioned, I believe to be the most important.

The interurban car has much in common with the city service car, but its service to the general public has been under different conditions. The call for, and bringing into existence, of the city service car was due to the increase of population in crowded cities. But the car operator in his wisdom, not only saw fit to take care of the congestion in the ever-increasing area of the city, but he also deemed it wise to extend the margin of cultivation by relieving this congestion and at the same time connecting the city to nearby towns and thus shorten the distance, as it were, between these points. This was a duty that was heretofore meagerly performed by the steam roads.

The ideal interurban car can also be safely considered under three headings—accommodation, speed, and comfort to passengers, and if these were fully dealt with, the complete ground would be covered. As to the structure of this car, it, like all structures, both natural and of man's production, depends on the use or purpose intended.

Owing to the fact that it gives a more frequent service than the steam road system, the interurban is an "accommodation" car. Because the electric interurban furnished a system of single units, frequent schedule and numerous stops, the general public was forced to give it the preference, and not because (as I have heard it said) that this car has assumed the same general appearance as the steam coach.

It is true that a majestic-looking car makes an agreeable impression, but this feature of appearance is of short duration when compared with a frequent schedule. In my opinion, many interurban cars are too long. They have, in some cases, been built about 60 ft. over all, and the present-day standard is about 52 ft. over all. This is not consistent with the fact that small units and frequent service are what have made the interurban car popular. It would seem that smaller cars and a greater number of runs are needed. A suitable car could have dimensions, say, 34 ft. over corner posts and 43 ft. over all and be provided with a saloon and smoking compartments. This car should have its platforms level with the floor of the car body and reached by a double step. Such a platform is in keeping with a high-speed car. Its height above the rail gives ample room for a high-speed truck with a 6-ft. wheel base and sufficient clearance for motors. It also permits of the center sills, which should be I-beams, extending from bumper to bumper. As to a car of this length not having sufficient weight to safely run at a high rate of speed, I would refer to the reports of the performance of the Strang car, which was only 32 ft. over all and ran at a maximum speed of 60 miles per hour and an average of 32½ miles per hour for long distances.

In considering speeds it is obvious that the trucks are an important part of the equipment. These should be of the heavy type with a wheel base of 6 ft. or 6 ft. 6 in. which would allow the motors to be hung inside. The wheels, of which there are many good makes in the market, should have M. C. B. tread and flange. This car, when possible, should be a one-way car, with a double-end brake and electric equipment, the rear end to be used only in case of emergency. The motorman should be partitioned off, as a precaution against being distracted from his duty.

This car should have the steam-coach type of roof as this design offers less air resistance than the monitor with bonnet. The side walls should be constructed with "W" bracing or double sheathed straight sides. As the comfort to passengers lies mainly in a liberal seat, this can be supplied since it is not often that the interurban car is restricted to width, as is her sister, the city service car. These seats should have high backs with head rests. All that has been said of the city service car in regard to heat and ventilation applies to the interurban rolling stock.

A Blank for Daily Comparative Statements.

The accompanying illustration is a reproduction of a very concise form for a daily comparative statement of earnings in use by the Rockford & Interurban Railway Co., Rockford, Ill. Space is provided for the daily earnings of the City, Belvidere, Freeport and Beloit Divisions and there is a space for the total earnings of

ROCKFORD & INTERURBAN RAILWAY COMPANY

DAILY REPORT OF EARNINGS FOR ______________ 1906

CITY DIVISION	BELVIDERE DIVISION	FREEPORT DIVISION	BELOIT DIVISION	TOTAL

COMPARATIVE STATEMENT OF EARNINGS

DIVISIONS	DAY		MONTH		YEAR	
	1905	1906	1905	1906	1905	1906
CITY DIVISION BELVIDERE DIVISION FREEPORT DIVISION						
BELOIT DIVISION						
TOTAL						

BLANK FOR DAILY COMPARATIVE STATEMENT. (ORIGINAL 8½ x 4 IN.)

the four divisions. Below are spaces for the comparative earnings of the various divisions for the day, month and year of the years 1905 and 1906. By means of this blank, the general manager is able to tell at a glance just what the road is earning compared with the same period of the year previous.

It is announced that the sixth annual session of the summer school for artisans, held under the direction of the College of Engineering of the University of Wisconsin, will commence on June 25th and continue for a period of six weeks. It is the wish of the university authorities to make the benefits to be derived from this school as far reaching as possible, principally to the young men who are unable to pursue a regular engineering course. This school was the first one giving this form of instruction, and while begun as an experiment, its continued growth has shown the demand for this kind of work.

A bulletin describing the work of the school in detail will be sent on application to Frederick E. Turneaure, Dean of the College of Engineering, Madison, Wis.

Snow Fighting in Wisconsin.

In the more southerly of the states of the East and middle West, the winter just past has been noted for its unusually open nature. The snow fall has been lighter than it has been for a number of years and in consequence the operating charges of both steam and electric interurban railways have been comparatively small. The interurban railways, with their lighter equipment, have been particularly benefited by this condition. There have, however, been

ONE OF THE HEAVY DRIFTS ENCOUNTERED.

a few roads in the northern states that have found the difficulties of snow fighting much the same as in the past.

The winters of northern Wisconsin are particularly severe and the electric roads of that region have had to fight a number of heavy falls of snow. The accompanying illustrations present, in a very forcible manner, an idea of the difficulties with which the Winnebago Traction Co., Oshkosh, Wis., has had to contend. In

TRACK CLEARED OF SNOW.

one view are shown drifts reaching nearly to the tops of the cars, which is, indeed, an unusual condition.

The equipment used consisted of two heavy electric locomotives coupled together, one of which was fitted with a heavy plow. By the use of these locomotives and the large plow, the track has been kept in condition for the operation of the regular schedule.

The Operator and Supply Man.*

BY W. R. GARTON.

In presenting this paper on the mutuality of interests of the operator and the supply man, please understand that by "operator" is meant the president, general manager, purchasing agent or whoever may be brought in contact with the supply man, and in using the term "supply man" it is treated in its broadest possible sense. I wish to have it understood that we will consider under this heading the manufacturer as well as the supply man and the representative of both interests, the traveling salesman.

First let us look briefly into some of the methods and accomplishments of the electric railway operator, contrasting the man.

THE SNOW PLOW IN ACTION.

his condition and environment with those of but a few years ago. When the old horse car was our most approved method of travel needs were few and skill, energy and forethought little required. It was nothing much more than the constant humdrum, doing today almost the same as yesterday. The public seemed satisfied with the nickel's worth of "horse haul," but with the electrifying of the street railway his influence began to spread beyond the narrow borders of the old conditions. The public began to rub its eyes and to realize a new lease of life. All this time the thrifty street railway man was wide awake. Today through this thrilling influence the world moves by strides. Thus of necessity the electric street railway man has made for himself a hustling environment, and he not only keeps pace but is generally in the lead. Today you find him the liveliest and most wide awake individual in the community He has become so filled with the

SNOW-FIGHTING EQUIPMENT.

result of his own achievement and the impetus he has gained that those coming into contact with him are compelled to assume much the same attitude, breathing the same atmosphere. The

*Read before the Iowa Street & Interurban Railway Association, Des Moines, April 20, 1906.

result often is that there is a sort of rivalry instead of a condition of mutual co-operation, whereby both may profit.

The operator is, in a large measure, responsible for the growth of the general field of this industry. But is it not equally true that the other gentleman is to be thanked for the development of new labor and time-saving productions, directly influencing the earning capacity of the railway properties? Of course this question, like all others, has two sides and each is worthy of careful consideration. Does not the operator too often assume the position of dictator, concluding that he is in control because he is the consumer and purchaser, but even though this is true, is it a just cause for the assumption of such a position arbitrarily, in justice to common progress? It may be answered "yes," and "no." "Yes" because the operator thinks he knows what he wants and when he wants it, and feels prepared to conclude for himself whether or not he shall spend the time in looking into that which the salesman thinks should have his earnest consideration. "No" because were it not for the activity of the aggressive producer he would not, nor could not, keep abreast of the rapid march and be an up-to-date live business man. It is the province of a real wide awake manufacturer, supply man or salesman to bring to the operator's attention the new ideas, and if he will co-operate, by proper selection, he must surely be the gainer.

This is not a matter of conjecture, but an established fact, because the supply man represents the most active and energetic class of business men, dealing with important problems. Today the average salesman representing this branch of the industry is not only a gentleman of tireless activity, habitual diligence and intelligence, but is possessed of a keen desire to apprise himself of a thorough knowledge and keep pace with the constant change for the betterment of the art; therefore, he can in many instances be looked upon as, in quite a degree, an expert in matters of this character. He is constantly schooling himself and gathering information at every turn. This may sound like a conclusion assumed for the sake of argument, but when it is known that he goes from one property to another in quest of knowledge it certainly is fair to assume that he can, if he will, become well versed, and he does. Note his records for a year. See how much of the development he is responsible for. He grasps the situation, applies himself, brings forward a means of accomplishing the carrying out of a principle incorporating advanced ideas for the success of his plans, which contemplates improved methods for the overcoming of weaknesses and simplifying the means of gaining greater proficiency in the operation of the railway and efficiency in the apparatus, much and always to the interest of the operator and his property.

Rivalry between competitors sometimes leads to indulgence in methods not above reproach, and from a keen desire to secure business, means are employed which are most vexatious. And it is to be regretted that in an endeavor to accomplish the substitution of one make of material for another, the operator is forced sometimes to sit in judgment, using his knowledge in arriving at a decision. Never could the adage, "Honesty is the best policy," be more forcibly and properly applied.

Possibly some operators do not believe in advertising, but without doubt it is a factor in their business enterprise, and they should employ the best means of keeping in close and constant touch with the public. Is not good service a chief requisite in the operation of business? Yes, and how can service and better service be obtained? By the application of best known principles, actively put into play through co-operation with the supply man, by taking advantage of the best known means of caring for his patron, the public. Who helps them to best serve the public if not the supply man? A chain is only as strong as its weakest link. No commercial, physical or social chain has yet reached its maximum strength. Therefore, we must be forever at it, strengthening our weak points. What is yours? What is mine? It may be lack of cordiality; if so, is it costing us anything? It certainly is. It costs nothing to be considerate, but inconsideration often proves more expensive than could have been calculated. The railway operator must, of necessity, meet many people at all times in numerous ways. He must be a politician, a diplomat, a statesman, a business man, a genial gentleman, and we find him all of these. But a man may blight his greater success by assuming that he can be successful of his own natural tact and ability without regard to his fellow, casting aside the missing link, "mutual co-operation." History records and every day confirms the fact that the greatest men are those who can influence and control the greatest number of individuals. And why are some men great? Is it not because of their power to pleasantly, but surely, influence and control? This just as forcibly applies to the supply man as to the operator.

The salesman who bores the life out of an operator for an order, while this operator is suffering with a toothache or bothered with some intricate problem which he is puzzling his brain to solve, would certainly be most indiscreet, and it is reasonable to suppose that the next time that salesman called he would be turned down and refused an audience, and justly.

There should be a stronger bond of harmony and a greater community of interest than is general. Such cannot but work for the betterment of all concerned. There must be some give and some take on both sides, as we all have our bitter pills to swallow.

Who helps to maintain and make a success of the great popular and ever-growing annual American Street & Interurban Railway convention? Is it not in a good measure the manufacturer and supply man? Remove this element and the attendant exhibit and do you not at once rob the whole institution of one of its prime factors? Who, but this same contingent forms the financial basis and backbone of the splendid electrical journals published in the interests of electric traction, progress and success, with their rich supply of valuable intelligence. Not that I would detract for one moment from the most worthy and successful efforts of the editor, but remove from these periodicals the advertisements of the manufacturer and supply man and it does not require argument to convince that these journals could not maintain their present status, and the splendid articles and other data could not be placed in the hands of the operator as they are today. But you may argue, "how could the supply man get on without the advertisement?" Please do not understand that there is any desire or intention to maintain that either the supply man or the operator could do without them for they could not. Here, I think, is one of the the further proofs of the real necessity of one for the other. The operator needs the magazine to aid him in keeping abreast of the times, and the supply man needs it to keep in touch with the operator and to keep the operator in touch with him. The reasonable conclusion must be that co-operation of these two interests through the medium of the electrical journal is truly essential.

Opportunity comes but once, 'tis true, but numerous opportunities are coming to us every day and no man, no matter who he may be or what his position, can afford to pass in any way a chance to add to his store of accumulations.

If all these interests can be drawn into closer harmony with fixed ideas of accomplishing the greatest possible good for all concerned, opportunities of vast import, that are in many instances given little or no thought or attention, can be taken advantage of, and as a natural sequence telling results will often accrue which may prove a boon, before little appreciated. If the operator has the heart and good will of the supply man and the supply man the high regard and kindly feeling of the operator that is hoped for, each can constantly render to the other almost invaluable service, which money cannot buy.

It should be firmly fixed in the minds of all that electric traction is the biggest, most gigantic and far-reaching question confronting the world today. And those active in bringing about a condition of higher standards are true sculptors in the art gallery of life, moulding with each day's efforts and successes, a greater and grander condition for the ennobling of mankind and the betterment of the people.

Excursion De Luxe.

The Inter-Urban Railway Co., of Des Moines, Ia., announces that a special car service from Des Moines to Colfax and Granger has been inaugurated and will continue through the summer season. The trips will be made on the company's special car "Iowa," which was illustrated and described in the "Street Railway Review" for April, 1906.

The price of the round trip including supper on the car will be $2.00. The number of passengers on each trip will be limited to 20 and reservations must be made in advance.

Personal.

MR. JOHN R. GRAHAM of Bangor, Me., has been elected president of the Lewiston, Brunswick & Bath Railroad Co.

MR. E. C. FOSTER was reelected president of the New Orleans Railway & Light Co. at a recent meeting of the new board of directors.

MR. A. W. BRADY was reelected president of the Indiana Union Traction Co. at a recent meeting of the directors held in Philadelphia.

MR. C. T. MORDOCK has been appointed general manager of the Terre Haute Traction & Light Co. to succeed Mr. Gardner F. Wells, recently resigned.

MR. G. S. W. BRUBAKER has been appointed superintendent of the traction lines of Shawnee, Okla., to fill the vacancy made by the resignation of Mr. R. S. Ives

MR. H. H. KIRKPATRICK has resigned as general manager of the Watauga Lighting & Power Co. to take up the work of building a street railway line at Tampa, Fla.

MR. ROBERT F. CARR, vice-president and general manager of the Dearborn Drug & Chemical Co., Chicago, was married on April 25th to Miss Louise B. Smiley, of Oak Park, Ill.

MR. C. N. WILCOXON, who has been general superintendent of the Cleveland & Southwestern Traction Co., has been elected general manager of this company. His appointment is effective immediately.

MR. HENRY C. MORRIS, manager of the Bay City Gas Co. and the Bay City Traction & Electric Co., was married on the evening of May 1st to Miss Elizabeth H. Cowell, of Saginaw, Mich.

MR. B. J. WEEKS has resigned his position as general manager of the Spokane Traction Co. Mr. Weeks has accepted a similar position with the Pacific Traction Co., Tacoma, Wash.

MR. I. W. BAILEY has been appointed superintendent of properties for the new east side corporation which has consolidated the East St. Louis & Suburban with the Alton, Granite & St. Louis lines. He will succeed Mr. J. F. Porter.

MR. F. J. WHEELER has been appointed general freight agent of the Schoepf-Morgan-McGowan traction interests in Ohio. Mr. Wheeler is considered an able freight man and was recently claim agent for the Cincinnati, Hamilton & Dayton R. R.

MR. ROBERT K. FAST has been placed in charge of the newly created electric railway department of the Central Electric Co., of Chicago. Mr. Fast has been with the Trolley Supply Co., of Canton, O., for the past three or four years and is well known to the trade.

MR. J. L. ADAMS, of South Manchester, Conn., has been appointed general manager of the former Appleyard lines. Mr. Adams will assume charge at once. He has been general manager of the Hartford, Manchester & Rockville Traction Co. of Connecticut.

MR. J. A. BENDURE has resigned as general manager of the Lima & Toledo Traction Co. and all of the Schoepf traction interests in Lima. Mr. Bendure went to Lima from Ft. Wayne about five years ago and has been prominent in the commercial affairs of the city.

MR. W. J. KELSH has been appointed superintendent of the Eastern Wisconsin Street Railway & Light Co., to succeed Mr. J. Davey, recently resigned. Mr. Kelsh is well versed in the duties he is assuming as he has had quite a varied and extensive street railway experience.

MR. A. C. WALTHER, electrical and mechanical engineer, formerly with Sargent & Lundy, Chicago, has accepted a position with Ford, Bacon & Davis, New York City. Mr. Walther has had considerable experience in the designing of large power stations and street railway systems.

MR. J. H. CRAWFORD has been appointed master mechanic of the Wheeling Traction Co. and its allied lines to fill the vacancy caused by the resignation of Mr. J. F. Ford. Mr. Crawford was previously master mechanic of the Southern Division of the Public Service Corporation of New Jersey.

MR. J. T. VOSS has been appointed general manager of the Ft. Worth & Rosen Heights Street Railway Co., in place of Mr. J. Goldgraber who resigned several months ago. Mr. Voss has been, until recently, manager of the Arlington Heights line and has had a long experience in street railway operation.

MR. R. B. STEARNS, formerly, superintendent of the Northwestern Elevated Railroad Co. of Chicago, has accepted the position of general manager of the Chicago & Milwaukee Electric Railroad Co.

MR. WILLIAM W. S. BUTLER, recently chief engineer and general superintendent of the Grand Rapids Railway Co., Grand Rapids, Mich., has resigned his position with that company.

MR. A. L. DRUM has resigned as general manager of the Chicago & Milwaukee Electric Railroad Co. Mr. Drum came with the company from the Indiana Union Traction Co., about a year ago.

MR. L. F. BOWER, formerly manager of the electrical works of the Allis-Chalmers Co. in Cincinnati, who was recently promoted to the position of comptroller of the company, has assumed his new duties, with headquarters at the general offices of the company in Milwaukee.

L. F. BOWER.

Mr. Bower was born and spent the early years of his life in Berwick, Pa. He attended Wesleyan University, Middletown, Conn., from which he graduated in 1879. For five years following graduation he held a position in the treasurer's office of the Jackson & Woodin Manufacturing Co., Berwick, Pa. Mr. Bower then spent three years in Carlisle, Pa., as principal of the preparatory department of Dickinson College. For one year thereafter he was managing partner of Bower & Hallery, chain manufacturers, in Carlisle, Pa. Having sold out his interest to the Standard Chain Co., he was for two years superintendent of the car department of the Allison Manufacturing Co., in Philadelphia, which concern he left on the death of Mr. Allison. For six years Mr. Bower was manager and treasurer of the Carlisle Manufacturing Co. in charge of all departments. From 1895 to 1901 he was secretary and treasurer of the Dickinson Manufacturing Co., of Scranton, Pa., manufacturers of locomotives and all kinds of heavy machinery. When the machinery department of that concern was absorbed by the Allis-Chalmers Co. in 1901, Mr. Bower was retained as manager of the Scranton plant until 1904. On April 1, 1904, he went to Cincinnati as secretary and treasurer of the Allis-Chalmers Co's. electrical department and in 1905 he was appointed manager.

MR. L. G. WHITE, who has been acting as general superintendent of the Columbus Railway & Light Co., was recently appointed to the position of general superintendent. Mr. White takes the position held by Mr. M. S. Hopkins who has resigned to take up his duties as general manager for E. W. Clark & Co.

MR. GARDNER F. WELLS, formerly general manager of the Terre Haute Traction & Light Co., was recently tendered a farewell banquet by a party of his personal friends and associates, on the eve of his departure for Boston. Mr. Wells will take up more confidential work for the Stone & Webster Co. in Boston.

MR. G. E. BENDER, who, for a number of years, has been assistant secretary of the Cleveland, Painesville & Eastern Railroad Co., with headquarters at Willoughby, O., has resigned and will be associated with the new banking and brokerage firm of Borton & Borton, with offices in the Guardian Trust Building, Cleveland, O.

MR. E. C. REICHARDT, formerly of the Houston Electric Co., has been appointed assistant treasurer of the Northern Texas Traction Co., with headquarters at Ft. Worth, Texas. He will take charge of the work formerly done by Secretary-Treasurer Clifford, who has been appointed superintendent of the operating department of the company.

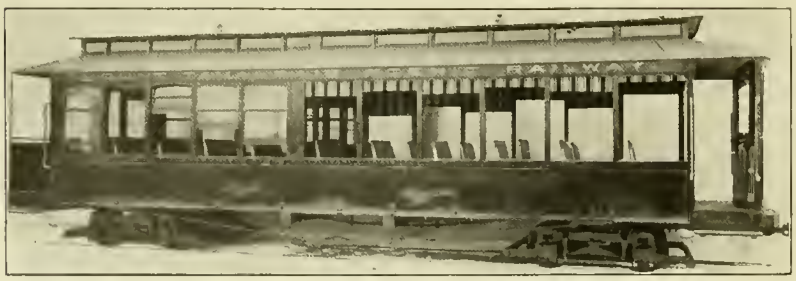
MR. L. A. OSBORNE, formerly third vice-president of the Westinghouse Electric & Manufacturing Co., was recently elected second vice-president to succeed Mr. F. H. Taylor, resigned. As third vice-president Mr. Osborne had the direction of the engineering and manufacturing activities of the company. As second vice-president he will assume the direction of the commercial activities of the company and at the same time will continue to direct the work of the engineering department.

New Equipment for the Mill Valley & Mount Tamalpais Scenic Railway of California.

The Mill Valley & Mount Tamalpais Scenic Ry. of California presents several unique features in railroading. As its name implies, the road was constructed solely for the purpose of transporting sight-seers to the top of Mount Tamalpais, from which point a very beautiful view of the surrounding country is obtained. A portion of the line is shown in the accompanying illustration and the difficulties under which the road is operated will be readily apparent. The height from the base to the top of the mountain is about half a mile, while the line of the railroad is over eight miles long. In this distance there are 281 curves, some of them having as short a radius as 75 ft. The longest piece of tangent is but 413 ft. in length, and, strange to say, is located in a portion of the road where the track parallels itself five times within a short distance.

PORTION OF ROUTE UP MOUNT TAMALPAIS.

The equipment of this road consists of open double-truck cars, mounted on Brill 27-G trucks. These cars are hauled by steam traction locomotives of a special type which burn oil. An addition has recently been made to the equipment, of a combination open and closed car which was furnished by the American Car Co. of St. Louis. As is shown in the illustration, the car is divided into two compartments, one open and the other closed, the latter affording ample protection to passengers during inclement weather. The semi-convertible feature is embodied in the closed compartment, allowing greater aisle space and an increased length of seat. The open compartment is entirely exposed and devoid of sash, curtains being provided as a protection from the wind and sun. Under the variable conditions of climate encountered in California, cars of this type are almost indispensable.



AMERICAN CAR CO. CAR FOR CALIFORNIA.

The dimensions of the car are: length over end panels, 30 ft. 11¾ in.; length over crown pieces, 36 ft. 11⅝ in.; length of open compartment, 17 ft. 2⅝ in.; width over sills including plates, 9 ft.; width over posts at belt, 9 ft.; centers of posts in open compartment, 2 ft. 9⅞ in.; centers in closed compartment, 2 ft. 6 in.; height from floor to ceiling, 8 ft. 5⅛ in.; height from track to under side of sills, 2 ft. 2 in.; height from under side of sills over roof, 9 ft. 2⅜ in.; height from track to platform step, 1 ft. 11 in.; length of seats, 38 in.; width of aisle, 28 in. The inside finish of the car, with the exception of the ceiling, is of golden oak, the ceilings being decorated with three-ply, veneer oak. There are 10 seats of the Brill type in the closed compartment and 12 in the open, the seats and backs being of golden oak. The front end of the car has a stationary vestibule while the rear end is fitted with an open dasher. The car is piped for steam heat. It is mounted on the same type of trucks as are the other cars on the line. The weight of the car with its trucks is about 21,800 lb.

Obituary.

Mr. Joseph L. Breen, recently general manager of the People's Railway Co., of Dayton, O., whose death was noted in the April issue of the "Street Railway Review," lost his life on Thursday, March 29th, by reason of a most distressing accident. During the recent construction of the Washington St. bridge over the Miami River in Dayton, the cars of the People's Railway Co. were operated over a temporary trestle. At times of freshet, large quantities of debris are carried into the river and it was on such an occasion that Mr. Breen, while crossing the trestle on a car, endeavored to inspect the supporting bents. In leaning out beyond the side of the car he came in contact with a pole attached to the trestle and was instantly killed. His body was thrown into the river and was not recovered until the morning of Wednesday, April 4th.

JOSEPH L. BREEN.

Mr. Breen was born in the city of Alexandria, Va., and at the time of his death was 40 years of age. Prior to 1892, he acquired his trade and was engaged in contracting on public works of various character in Virginia and North Carolina. In July, 1892, he became assistant superintendent of construction for the Woodbridge & Turner Engineering Co. of New York City and supervised the building of the Washington, Alexandria & Mt. Vernon Electric Ry., the railway constructed by the Brigantine Transit Co., a considerable portion of the system of the Union Traction Co. and the Chester, Darby & Philadelphia Railway Co., of Chester, the old York Road line of the People's Traction Co. of Philadelphia and numerous other branches and extensions in Pennsylvania and New Jersey.

For a time, Mr. Breen was engaged on the reconstruction of the Second Ave. line in New York City and afterwards became assistant superintendent of the special-work shop of the Union Traction Co. of Philadelphia. From 1897 to 1899 he was engaged in track construction and cast-welding operations with the William Wharton, Jr. Co. Inc., in Philadelphia, Baltimore and elsewhere. During the winter of 1899-1900, Mr. Breen was appointed superintendent of construction for the American Railways Co. of Philadelphia and supervised the erection of the power plant of the Bridgeton Electric Co., Bridgeton, N. J., the construction of the Chicago & Joliet Electric Ry. and the construction of extensions of the People's Railway Co. in Dayton. In September, 1902, he was made general manager of the People's Railway Co. and occupied this position until the time of his death.

Mr. Breen was married and had eight children. He was consistently loyal to his family, friends and business associates and his death has caused much sorrow.

The Atlantic Avenue Station of the East Boston Tunnel.

One of the most unique electric railway passenger stations in the world was placed in operation in Boston, on April 5, 1906. This was the Atlantic Ave. station of the East Boston Tunnel, located at the foot of State St. and adjoining the State St. station of the Boston Elevated Railway Co's. "Atlantic Circuit" double-track elevated line, which stands at the corner of Atlantic Ave. and State St. In its arrangement and equipment, the new station contains many features of unusual interest. It affords a connection between the East Boston Tunnel and the elevated system proper, with provision for the reception and discharge of passengers at the street levels as well. Complete arrangements have been made for the safety of the traveling public in the station and its approaches, and the various facilities for transfer offered, have been reduced to extremely simple terms, considering the complication of the problem of handling large crowds rapidly between an east and west double-track deep tunnel, a north and south double-track elevated line and a surface level between.

The Atlantic Ave. station contains seven floors, of which four are built below the State St. level. In normal operation, only three of the floors are used by the public; the tunnel platform, the State St. level and the elevated structure level. These are connected by four electric elevators of unique design and by emergency stairways. From the top of the rails in the tunnel to the floor level at State St., the vertical distance is 57 ft. making a vertical distance of about 56 ft. between the tunnel platform and the State St. level. In other words, the portion of the station below the surface is equivalent in height to a five or six-story building, on account of the downward grade of the tunnel which passes beneath the waters of Boston Harbor soon after leaving the Atlantic Ave. platform. The connection between the two stations is effected by an overhead foot bridge, which leads to a single short flight of steps connecting with the State St. elevated platform, as is shown in the illustration of the exterior. Here the elevated station is seen on the right, the foot passage in the center and the east end of the tunnel station with its three stories above the street in the foreground. The top story is called the "machinery loft." It contains the driving and controlling mechanism of the elevators. These elevators have a total travel of 70 ft. between the tunnel platform

BRIDGE FROM TUNNEL STATION TO ELEVATED ROAD SHOWING DETAILS OF INTERIOR FINISH.

of the Atlantic Ave. station and the level of the elevated foot bridge, which is the end of their travel.

The tunnel station platforms at the lowest level are two in number, one for east-bound and one for west-bound cars. These are each 160 ft. long and 10 ft. wide, and are covered by a masonry arched roof. A view is shown, taken in the tunnel at the Atlantic Ave. platform, looking in the direction of East Boston. To prevent passengers crossing from one side to the other at this level, an iron fence has been erected between the east and west-bound tracks. At the east of each platform is a space about 32 ft. long and 18 ft. wide which is reserved for elevators, stairways and approaches. These and the track space between, are included in a larger space, 40 ft. by 57 ft. 4 in. which is nearly enclosed by four vertical walls extending to the State St. surface. These walls are

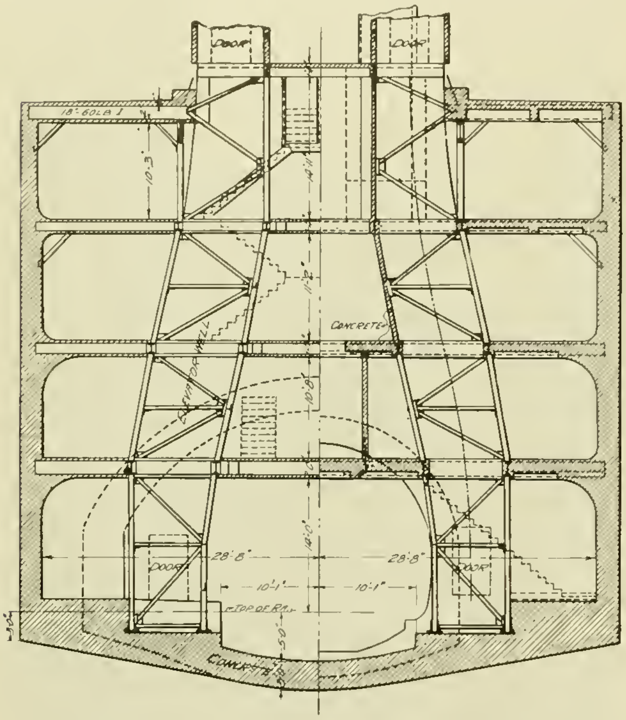
EXTERIOR OF THE NEW ATLANTIC AVE. STATION

of concrete and are from 21 in. to 36 in. thick, reinforced by twisted steel bars. They are connected by three floors (see vertical section), which altogether, form four chambers used for storage and the housing of various auxiliary apparatus. At the westerly ends of the tunnel platforms, are two 4-ft. emergency stairways which unite at the top of the tunnel arch in a single stairway 7 ft. wide leading to the surface of State St. This long stairway has 95 steps and in the event of any panic, would undoubtedly serve to cool the excitement of the most active person leaving the tunnel. At the top of this stairway is a concrete-steel shelter with a glass and metal roof. The long stairway is designed so that at any time an escalator can be installed upon half its width if desired.

The easterly stairways and elevators are covered by the three-story building, which is 84 ft. long and 29 ft. wide. The entrance is at the easterly end and the exits are at the sides and west end. The second floor is about 13 ft. 6 in. above the street and the building is constructed with a steel frame to which are attached an inside and an outside covering of steel furring and wire lath covered with cement plaster, in most cases forming hollow walls. All steel is covered with cement mortar. The floors and roof are of concrete and wire or expanded metal except the part of the roof over the ends of the building, which is of metal and glass. The paneling is of copper, laid on cement, and the window openings on the first floor are only partially closed with glass, the space above being left open for air supply. No woodwork shows in the station, tiling being plentifully used on exposed walls. An excellent idea of the architectural finish of the interior may be had from the illustration of the passageway leading to the elevated railway.

The plan of the tunnel, surface and elevated levels, is illustrated. Three 46-ft. tunnel cars can load and discharge passengers at the same time on either side. The East Boston Tunnel is equipped with automatic block signals which permit several cars at a time to

occupy either the east or west-bound track. Both sides of the station are served by the elevators, and on the street and elevated levels, passengers may cross from side to side at will. On the elevated level, there are no ticket or toll offices; on the street level, there is a ticket office only; and on the tunnel level, there are two toll of-



TYPICAL CROSS-SECTION OF THE ATLANTIC AVE. STATION.

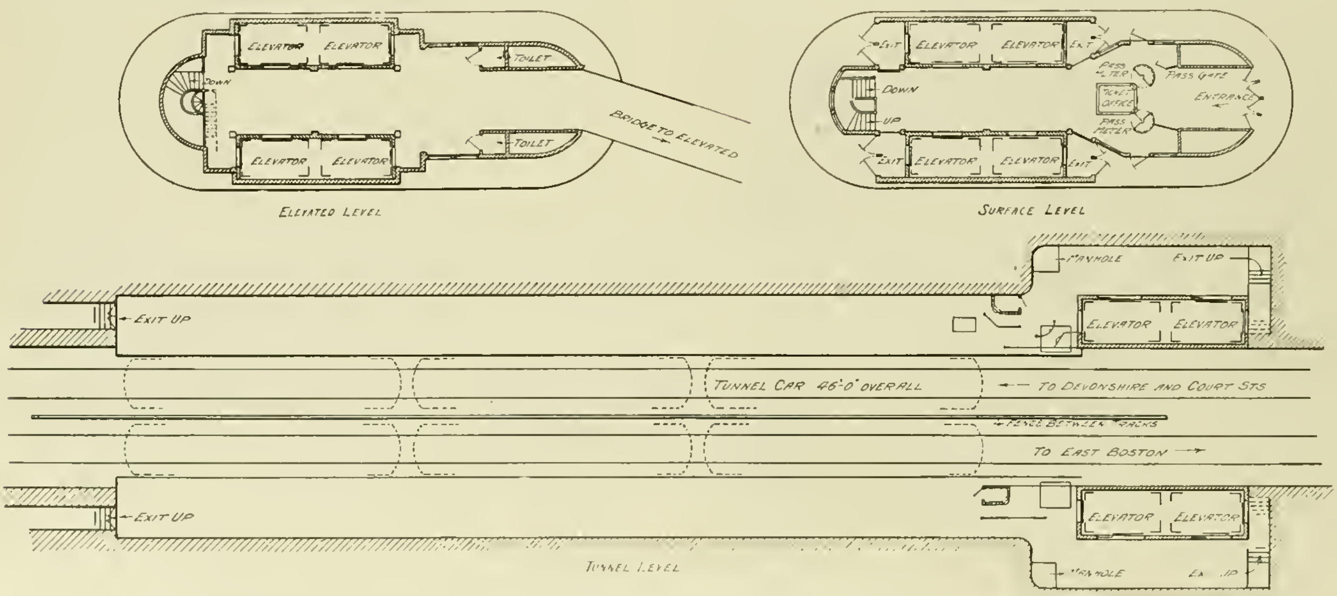
fices, one for entrance toll and one for exit toll. All passengers in the tunnel are required, by law, to pay a toll of one cent in addition to the regular five-cent fare which the company collects. This toll is paid to the city of Boston by the company, which simply acts as the agent of the city in collecting it. All tolls are collected at the stations on the Boston side of the harbor. Passengers entering the Atlantic Ave. station at the surface level, pay the regu-

desired, these stairs can be thrown into service and passengers allowed to climb to the street level past the three chamber floors. The stairways at the west end of each tunnel platform are closed by a pair of small swinging gates which are not locked; these can readily be opened in case it should be the desire of passengers to walk up the long stairway previously mentioned, to the street level. On the street and elevated levels, each aisle space between the elevators is 11 ft. 6 in. wide, which gives ample room for the handling of the full load of each elevator's passengers.

The elevators are without doubt the most interesting feature of

TUNNEL PLATFORM ATLANTIC AVE. STATION.

the equipment of this station, for in some particulars they are probably different from any other elevators in the world. A glance at the vertical section shows that if the elevator shaft had been built vertically from the tunnel platform to the street on account of the distance between the elevators at the tunnel level the roadway on each side of the exterior station building would have been seriously obstructed. Hence it was necessary that the elevator cars should travel a horizontal distance of 6 ft. while traveling the vertical distance of 56 ft. The cars were therefore designed to run on curved girders arranged to keep the car floors level at all times, and the center line of the elevator well describes a reversed curve through which the car rises in passing from the tunnel to the street level. The last part of the run, from the street level to



THE ATLANTIC AVE. STATION OF THE EAST BOSTON TUNNEL.—PLAN VIEWS OF THREE LEVELS.

lar fare of five cents and are carried to the elevated platform passageway level without extra charge, if they desire.

At the east end of each tunnel platform is an emergency stairway which is normally closed to travel. The east flight of stairs on each side is hinged at the top and suspended by a pulley with the lowest step above the platform level. At any time when it is

the elevated platform, is perpendicular. The elevators were supplied by the Whittier Machine Co. of Boston.

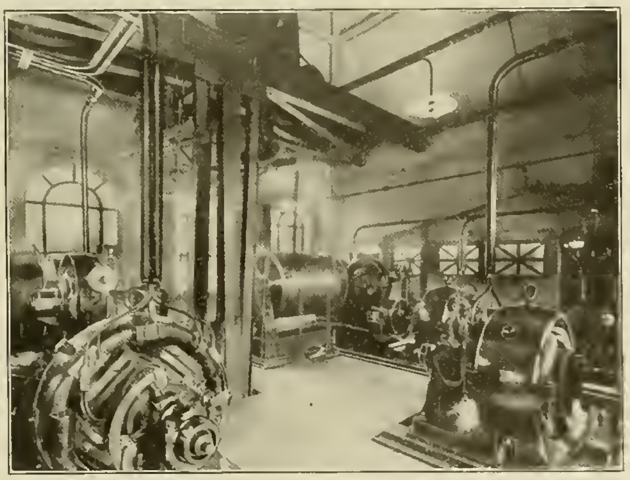
Each of the four elevators is electrically driven by a separate motor rated at 87.5 h. p. and located in the machinery loft. This room is 35 ft. 6 in. long by 25 ft. wide. Each elevator car is 11 ft. 9 in. long by 6 ft. 4 in. wide and holds from 40 to 50 people.

The motors are designed for a normal passenger load of 120 lbs. per sq. ft. The normal speed of each car is 250 ft. per minute. The motors drive the winding drums through a worm gearing. One of the illustrations shows the elevator equipments in the machinery loft. Each car equipment has an electro-mechanical brake on the main shaft, winding drum, counter weight and hoisting cables. Each car has a steel frame built so that there will not be any permanent distortion under the most severe cases of loading, should one safety device act before the other. The guide shoes for both the wood girder and the steel girder, are of cast steel with adjustable gibs and springs.

Each car is equipped with two triple-grip safeties, one upon each of the wooden girder rails. These are brought into action in case of excessive speed by an Otis governor located at the head of the shaft in the machinery loft. The governor simply trips the safety devices in case of trouble, throwing the knives of the latter at an angle which drives them into the wooden girders, stopping the car. In a test made with a car loaded with 6,000 lbs. of pig iron, cushioned with a mattress, the car was dropped after cutting the lashings loose. It fell 12½ in. before the safeties engaged, and came to rest in 27½ in. from the start. Under test the efficiency from the motor terminals to the car, running between the tunnel platform and the street level with full load and full speed, was found to be about 60 per cent, which was the contract requirement. The safety brings the car to rest without injurious shock, and locks the car to the girder so that the car cannot descend without first having been lifted, when the safety disengages and resets. The cars and counter balances are provided with oil buffers. Each elevator motor is provided with a centrifugal speed governor driven by the armature shaft which stops the motor automatically in case the speed increases 10 per cent above the normal. Automatic stop switches are provided at the top and bottom landings. Full speed of the car, ascending or descending, is attained in about four seconds after the start. The elevator control is of the electric magnet type. Each elevator is equipped with a four-spot annunciator with signal push buttons at the landings.

In making the efficiency tests, each car was run for 10 hours, loaded to 120 lbs. per sq. ft. of net platform area, between the tunnel platform and the upper landing at the rate of 40 round trips per hour. Each car is equipped with a telephone so that the operator can communicate with the machinery loft at any time and the cars can be operated from the machinery loft as well as from their own interiors.

Each elevator has three doors and there are also doors on three sides of the shaft on the various floors. The use of compressed air for operating these doors makes it possible for the operator to



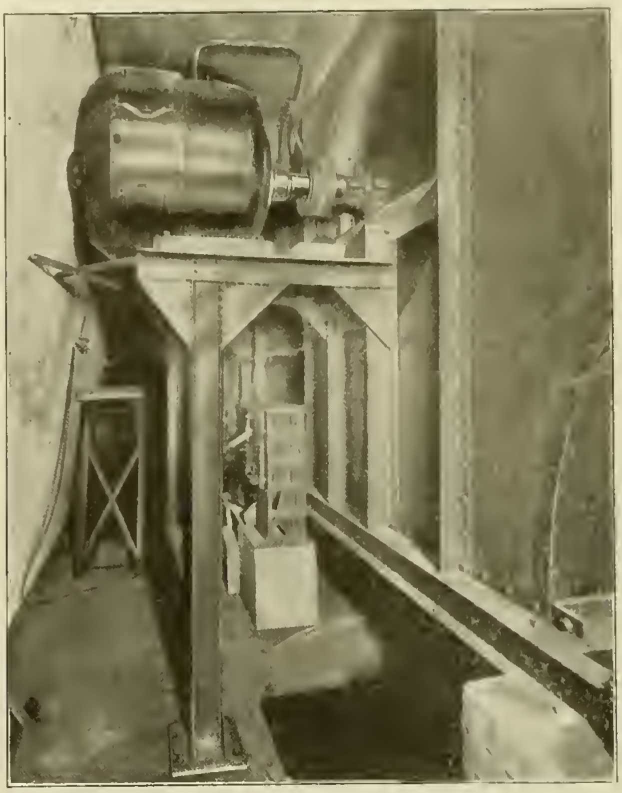
MACHINERY LOFT, ATLANTIC AVE. STATION.

give full attention to the control of the car. The air is supplied through a pressure regulator from the signal pipe line of the Boston Elevated Railway Co.

Each elevator has a suitable switchboard in the machinery loft Besides the telephone connections, the machinery loft is supplied with an alarm bell signal which operates in case anything goes wrong in the chamber which contains the tunnel signal apparatus.

The signal equipment for the tunnel is installed in a chamber on the first floor above the tunnel platform. On this and on other floors, the elevator hatchways are provided with emergency doors to be used in case a car should become stalled between the tunnel level and the street.

The signal equipment consists of a double set of 5-kw. General Electric motor generators, converting the trolley current at 575



VENTILATING FAN AND AIR CHAMBER, ATLANTIC AVE. STATION.

volts into single-phase, 60-cycle, alternating current at 500 volts. A four-panel switchboard controls the outfit. The circuit breakers on the switchboard are wired to the alarm bell previously mentioned as located in the machinery loft. The tunnel signals are operated by alternating current and the current supply from the Atlantic Ave. chamber at 500 volts is suitably transformed for the track circuit work in each block. The motor-generator sets are equipped with automatic starting devices which operate in case of low-voltage release. Electric heaters are used in this room to keep the air thoroughly dry, and an emergency connection for 500-volt alternating current is arranged with the Edison Electric Illuminating Co., of Boston through a special transformer for station lighting located in another chamber.

Above the tunnel platform are two air chambers in each of which is installed a 15 h. p., 575-volt motor, direct connected to an 84-in. double-inlet induced-draft fan which forms part of the tunnel ventilation system; the fans draw the foul air up through the false roof which extends through the tunnel and discharge it into the external air through a duct extending up through the Atlantic Ave. station to the roof.

The power supply for the Atlantic Ave. station elevators is drawn from the company's Lincoln power station, a special 575-volt feeder being available for this purpose. An additional reserve connection is made with a through feeder from Lincoln power station southward towards Central power station. The station lighting installation includes 90, 16-c. p., 110-volt series lamps, 15, 32-c. p. series incandescents, 15, 110-volt arc lamps and 20, 55-c. p. series incandescents run upon the elevated railroad direct-current, 575-volt power supply; and as a reserve 6 arcs, 9, 55-c. p. incandescents, 6, 32-c. p. incandescents and 1, 16-c. p. lamp operated in multiple upon a 110-volt Edison circuit. The elevated railroad light supply may be either from Lincoln power station, Central power station, or from the tunnel trolley circuit. In case the elevated supply fails, an automatic switch at Devonshire St. station throws every

incandescent lamp in the tunnel and its stations upon the Edison service. The greatest care has thus been taken to avoid the occurrence of darkness in the tunnel or any stations.

A considerable force of employes is required to operate the Atlantic Ave. station. This force includes, all told, two station masters, two electricians for the machinery room, two ticket sellers, four toll collectors for the tunnel platform and also four toll watchmen, four elevator men and one porter—a total of 19 men. About half of these men are on duty at any one time. The station is in service from 5:30 a. m. to 12:30 a. m. From 6:30 to 9:00 a. m., two west-bound platform and one east-bound platform elevators are operated; from 4:00 to 6:30 p. m. two east-bound and one west-bound elevators meet the requirements of traffic. The station was built by the Boston Transit Commission, and is leased for operation with the rest of the tunnel and its permanent fixtures to the Boston Elevated Railway Co. Acknowledgements are due to C. S. Sergeant, vice-president of the Boston Elevated Railway Co. and to the Boston Transit Commission, for courtesies extended in the preparation of this article.

Transfers.*

BY JOHN F. OHMER, DAYTON, OHIO.

So much has been said and written about transfers, their uses and abuses, that the subject has grown threadbare, but so little has been said along the lines of prescribing remedies to cure the evils that, in my opinion, there is room for further discussion. The common medium of exchange given passengers whereby they are permitted to leave one car for another continuous journey is called a "transfer," but the application of this transfer to so many and varied uses suggests the propriety of giving it another name. Instead of the transfer serving its purpose as a medium of exchange for a continuous ride upon the first connecting car, it seems to have developed into a commercial product subject to various uses. It is a stop-over privilege ticket subject to the use of the holder or his transferee. It has developed into a commodity, bought and sold by newsboys; it is in some cases an exchange ticket for the convenience of clerks and employes in large stores living in different directions, and it is not unusual to find it an exchange ticket for cash wherever it can be substituted for cash by the dishonest employe. It is used in all colors under the sun, and the forms of printing are as varied in number as there are railroads in the country. Every road has its own particular form which is always thought best. Some have identification pictured transfers.

About a year ago the very able president of the American Street Railway Association, in discussing this question, said: "My mind has an element of practicability, and within the last four weeks this thought has shaped itself in my mind: That owing to the ability that has been manifested by the originators of transfer tickets in refining the transfer—the emblem which we give to a passenger which entitles him to a second, and third, and fourth ride— they have refined it to such a small piece of paper in such a small form, with so little upon it, and that being represented in shaded parts and certain cabalistic forms to be punched two or three times, and in view of the fact that the transfer has to be issued quickly and used quickly, we have something no one can understand. How can you expect a man to be honest in the use of a thing he cannot understand? How can you expect a court to protect our rights, if we issue to a man who is entitled to ride upon our cars a thing which, when presented to an impartial and able man, he would find himself at a loss to decipher?"

The transfer is a convenience to the public, and it was introduced for the purpose of permitting the passenger to continue his journey in another car than that upon which he pays his fare, but its successful introduction and popularity have brought about conditions under city ordinances which were not at all contemplated by railroad companies. Among those unjust and discriminating ordinances there are none which work so much hardship to the railroad companies as the giving of transfers in exchange for a transfer. A passenger pays five cents and transfers to another line, the second line divides with the first, each line getting two and one-half cents. The passenger transfers the second time, and on the same pro rata basis each line will get one and one-fourth cents for the ride, and by continuing to transfer from one car to another in his merry-go-round about the city, the pro rata subdivision of payment for that ride becomes so small that the company might actually pay the passenger for riding upon its cars. In other words, the railroad company cannot issue indiscriminately transfer upon a transfer without sustaining direct loss, to say nothing of the indirect losses by reason of multiple opportunities for manipulation.

Before the introduction of interurban service the traveling public was content to pay 25 or 50 cents to the transfer companies for a ride from the steam railroad station to the hotels in the city. Now the interurban cars invariably run to the best hotels in nearly all cities, and save to the passenger the 25 or 50 cents that he was satisfied to pay to the transfer companies connecting with the steam lines. This extraordinary benefit and economy derived from interurban service the public generally appreciates until some wiseacre conceived the idea that it would be a good thing for the interurbans to issue transfers. The subject is agitated and an ordinance introduced, and the interurban company, in addition to its satisfactory and economical service, is compelled to issue and receive transfers to and from other lines. Why should a traction car, conveying passengers from one city to another, be compelled to exchange transfers with the city properties any more than should the steam lines be compelled to exchange transfers with the car lines running to the steam road stations? The ordinary alderman is too elastic and readily yields to any proposition which seems to burden the railroad companies.

Abuses.

The transfer is abused by the employe, by the public, and by the company. It might be unnecessary to refer to the abuses chargeable to the employe, for since the introduction of the transfer system the employe has been the target to which all losses and complications, arising from the use of transfers, have been directed. But from my own personal observation, I incline to the opinion that more losses are sustained by the railroad company from the abuses of the public than from those of the employe, and that ordinarily the company itself is responsible for the abuses by both the public and the employe. Some of you may seem surprised at this statement, and I dare say that never before has it been charged that the company has been made a party to the manipulation. The highest wages paid to the conductor is a small per cent of the total collections made by him. He handles thousands and tens of thousands of nickels weekly, and it is so easy for him to convince himself that he has not received for his work a fair proportion of the amount collected, and the substitution of transfers for cash fares seems to be the most satisfactory way to increase his revenue. Many companies in the larger cities still cling to the old-time one-fare register. The conductor is instructed to ring up five-cent fares and transfers together. In settlement he must have a total of five-cent fares and transfers to correspond to the total number registered, and no matter how many transfers are substituted for cash fares so long as he turns in the proper total, he complies with the rules of the company. Thus is his conscience cleared. Other companies in the larger cities, having a one-fare register only, undertake to eliminate the substitution of transfers for cash by issuing a manifesto that the transfers have no cash value to the conductor, and thereby do not register transfer collections. Just how the cash value of a transfer is removed, because the company decides it has no value and that it need not be registered, has never been explained, nor can it be explained.

So long as a transfer is good as a medium of exchange for transportation just so long does the cash value remain, and manifestos or orders from the railroad office to the contrary, notwithstanding, do not remove its cash value which remains until the transfer is actually in the hands of the cashier of the company. Its cash value to the passenger ceases by its time limitation, but its cash value does not cease so far as the conductor is concerned until he has made his returns, either directly or indirectly, to the company for all collections made. The non-registration of transfers offers to the yielding conductor a better, or at least an equal opportunity to manipulate where transfers and cash are

*Read before the Iowa Street & Interurban Railway Association, Des Moines, April 19, 1906.

registered together; although he is told by the company that the cash value is removed from the transfer and that he must not register it, at the same time he is required to collect from every passenger either a five-cent fare or a transfer for the ride. Every conductor appreciates that the little transfer has its five-cent value just the same, and his rake-off is measured by the number of fares collected and not registered. The transfers not being registered make it easy to omit the registration of cash fares.

I maintain that the railroad company is directly responsible for these abuses, first, by not providing a system for accounting separately. for the several collections made, and secondly, by assuming to remove the cash value from the transfer and not registering the collection of transfers at all. The fact of registering five-cent fares and transfers together by no means will give results that can possibly be a unit of either, and the number of each to be turned in to make a general result may vary according to the elasticity of the conductor's conscience. In the second case a conductor finds it easy to manipulate transfers which, by order of the company, have no cash value. Formerly these propositions were hard of solution, but since the introduction of the plurality fare recording register there is absolutely no excuse for either registering cash fares and transfers together or not registering transfers at all, assuming that they have no value, and the abuses which follow are, in a large measure, chargeable to the management which continues to operate upon these theories.

Abuses by the Public.

The railroad company is a creature of the public and is subject to its desires. As a rule the public fails to appreciate legislation affecting the rights of any public utility service, and it fails likewise to respect the rules and regulations made by the utility company for the interests of the public, but it does not fail to take advantage of all opportunities offered, apparently to its advantage.

One of the early and best innovations to the transfer was the time limit, which was introduced by the well-known transfer expert, J. H. Stedman, of Rochester, N. Y. He provided the means for fixing time limitations.

Statistics show the following with respect to the operation of the Chicago City Railway Co's. transfer system, as representing the growth and development of the use of transfers over a period of 20 years, 1884 to 1904:

	1884	1904
Number of distinct routes operated	19	182
Number of transfer points	2	91
Average number of transfer passengers carried daily	4,000	207,728

From these figures one will realize the enormous increase in the transfer distribution, and it is safe to presume that the same average increases are shown elsewhere every year. With this enormous increased traffic it is an impossibility for the conductor to punch, by hand, the time limitations on each transfer issued. If he takes time to do this, he will do it at the expense of collecting some of the cash fares, and rather than lose fares he is licensed to punch the transfers as best he can, and it naturally follows that there is no regularity about time limits, and the passenger is not slow to recognize this fact, and takes advantage of the opportunity to use the transfer as a stop-over privilege good for himself or transferee, being mindful always that a five-cent value attaches to the transfer within the time limitation. For this reason a large number of passengers ask for transfers for no other purpose than to use them for stop-over privileges or to apply them in other advantageous channels. It is difficult to measure the losses from this well-known abuse by the public, but it is sufficient to say that the loss sustained is very great.

I have not endeavored to go into detail defining the abuses specifically, for I am quite sure you are all acquainted with the many devices and schemes employed both by the employe and the public, and besides, it is so much easier to find fault and to point out defects and irregularities than is it to prescribe remedies.

Remedies.

Let the transfer be simple in form. One distinctly printed. One easily read and understood. One that can be rapidly yet accurately issued with the proper time limitations, and one that will, without confusion, transfer passengers from the car of one line to that of another within the prescribed limitations. It would be rather difficult to prescribe a form of universal transfer which might be used upon all roads and under all conditions, but that the majority of railroad companies could unite upon a system of transfer, the character of which might be generally uniform, there can be no question of doubt. The streets or transfer point connections are not necessary in the majority of cases. Issue the transfer with the time limitations and direction properly indicated It matters not whether the passenger takes a white or green car so long as he boards either one within the prescribed limitation and in the direction designated. Some of the largest cities have eliminated the indication of connections, others have expressed their intention of doing so. A number of companies have more transfer points than can conveniently be printed and punched, separately, so they are printed in blocks, two, three and four points together and the block punched, giving to the passenger the option to take any line included within the block. Why not eliminate the designation of street connections? The transfers used on the north and south lines of the New York City Railway Co are good on any of the crosstown lines. The transfers issued by the crosstown lines are good upon any of the cars of the transverse north and south lines. The elimination of street connections lessens the burden of the conductor and gives the passenger an option of taking one of several lines moving in the same direction for which the transfer has been issued, but he has no more latitude than the exercise of his option to ask for a transfer upon any line he desires. Omit the street limitations and save to your conductor time which is lost by ascertaining from his passengers the line upon which they desire to transfer. If the question of direction only is involved, it will simply be north or south, east or west, and no further questions asked.

At the 23rd annual meeting of the American Street Railway Association in St. Louis, in 1904, a paper on transfers was read by Mr. Jewell, of the Chicago City Railway Co. This paper provoked considerable discussion, participated in by the most prominent railway officials in the country. Among others entering the discussion was H. H. Vreeland, of New York. I quote from his concluding remarks: "We have found that on the principal lines of the system the enforcement of the time question is an absolute impossibility. It is quite evident that with the great press of traffic the conductors are bound to make mistakes in punching the time or transfer point, and this weakness in the system has caused the officers to hesitate in the enforcement of the company's right of ejection and criminal procedure. Some system must necessarily be devised to obviate the present difficulty of properly punching the tickets and enable the company handling large quantities of traffic to make a better use of the time provision than it can do at present."

As previously stated, the conductor with the hand punch must either sacrifice fares at the expense of properly punching the time limitations, or if he is instructed to collect his fares first and punch the transfers as best he can, then he takes advantage of the license and either punches many transfers together or punches them at his own convenience and irrespective of time limitations. From the time a transfer is issued and until the expiration of its time limitation it has a fixed value equivalent to the price charged for a fare, and the indiscriminate issue and giving way of transfers will be largely limited if a registration is made for each. Besides, if each transfer issued is registered, the conductor cannot and will not issue transfers indiscriminately for fear of detection. With the ordinary transfer pad and hand punch both hands of the conductor must be used, and any system that will relieve both the mental and manual work of the conductor should be a welcome innovation.

A system that will enable the conductor, with practically a single operation, to issue, record and perforate the time limitations accurately and with dispatch, and not to require more than one of his hands to do it, would be ideal. This is found in the ohmergraph, a little machine worn on the side of the conductor. It will perforate the month, the day, the direction, the hour and the fractions, and it issues and records each transfer in less time than the conductor could place his hand in his pocket for a pad. Transfers put up in rolls of 200 and 300 each are enclosed within the machine. They are checked out to the conductor by the consecutive number and also by the register record. The operation requires the use of only one hand of the conductor, and the trans-

fer is properly punched, issued and recorded in one operation by the movement of a single lever. While it might be preferable to eliminate the perforation of the connecting line, at the same time the ohmergraph will perforate anything printed upon the transfer, but it will require a movement of the perforator each time the connecting line is changed. With each transfer issued the bell rings, and the number of bell rings must indicate the number issued. The punches for the month and day are enclosed in the machine and are not accessible to the conductor. The punches controlling the hours, the minutes and the direction are available to the conductor and can be set in an instant to the required time, and the conductor needs only to move the hour punch once an hour and the minute punch once in 15 minutes. The direction punch is moved simultaneously with the issuing of a transfer.

To check the abuses which emanate from the careless manner of collecting transfers it is important, first, to bear in mind the fact that the transfer is a medium of exchange and has a value, although the value may not be figured on an equal basis with a cash fare, for which reason it is all the more important that a record of the transfers be made separately. This can only be done with a system for registering and indicating, separately, the different fares, and the recorder in the register practically receipts to the company for all collections made upon each trip. By employing this system of operation, the company adopts a business and practical method of separate accounting, calling each item by its own name and getting a separate record for each accordingly. With it the conductor or other employe's motives are not questioned, for his moral worth is measured by his record; the record being under his control, for which he and he alone is responsible, places upon him a moral responsibility which he must respect, and the best results will follow.

Transfers are now used upon all or nearly all city properties, and the number used will vary according to the size of the city and the traffic. The growth has been enormous, and carefully compiled statistics show that the use of transfers has grown beyond the normal increased traffic, while the average fare per passenger (cash and transfer passengers) has seriously decreased. It will be interesting to note some data taken from a recent comparative report of one of our largest city railways:

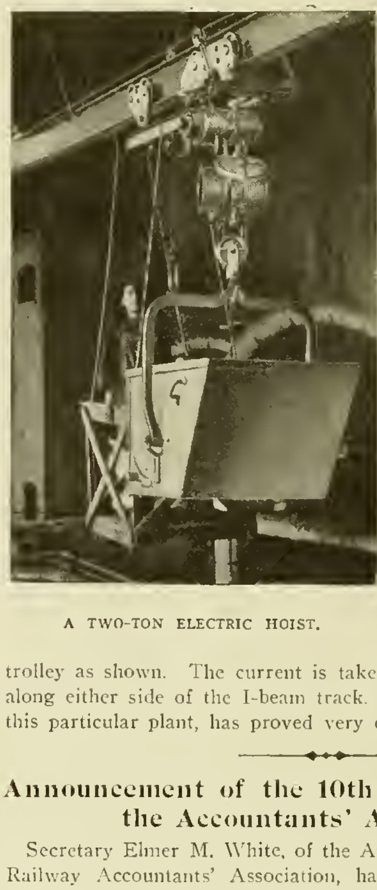
	1884	1904
The percentage of transfer passengers to cash passengers	4.6 per cent	50.7 per cent
Average fare per passenger (cash and transfer passengers)	$0.0478	$0.0313

This shows an average decrease fare per passenger of 32.5 per cent, which, if applied to the gross traffic earnings of $2,000,000 per annum, figures a shrinkage of $650,000, and on gross traffic earnings of $8,000,000 shows a shrinkage of $2,600,000, while the average length of lines increased about 100 per cent, with chances for manipulation and abuses increasing accordingly. These figures are rather startling, and I dare say their application would be pertinent pro rata to all city companies. Does it not, therefore, behoove the authorities in control to give time to this most important question for serious consideration? It may not be surprising for me to tell you that some managers do not even know the classification of fares collected upon their lines, much less do they know and give consideration to details affecting the fare collection service. I have always contended, and again state, without fear of successful contradiction, that there is no part of the railway business comparable in importance to the fare collection service, and I am sorry to say that it is grossly neglected by some managements. The revenue means everything to the physical and financial success of the company, and the best service which surrounds and protects fare collections is none too good, and its cost should be a secondary consideration. Many managers are handicapped in this important measure. The financial control dominating the operation dictates details assuming to be along the lines of economical management, and the question of the adoption of modern ideas for protecting fares and fare collections is not given due consideration, and, therefore, cannot be intelligently acted upon. The question of cost in most cases seems to dominate the action of the average impractical director; he does not take into consideration the value of what he receives and the benefits to be derived. It is to this dominating interest rather than to the practical operating forces I lay the blame for many of the abuses prevailing with the transfer system, and until the "powers that be" come to a full realization of the subject and its importance, we cannot hope for much better conditions. The general manager should be given full and absolute authority in this matter, and if he has not the time necessary to make the proper investigation, he should delegate a committee or an understudy to devote the preliminary time for the purpose. Every manager knows the weakness, but few seem to seek proper remedies. The abuses are found in both the distribution and the collection of transfers. The ohmergraph offers a solution to the former and the plurality recording register a solution to the latter. A careful analysis and investigation of the whole subject will satisfy the most skeptical of my contention.

We flatter ourselves by claiming to be rational and intellectual beings, but it would be a great mistake to suppose that men are always guided by reason. We are strange, inconsistent creatures, and act quite as often, perhaps oftener, from prejudice or passion. The result is that we are more likely to carry men with us by enlisting their feelings than by convincing their reason. This applies to companies of men even more than individuals. Use your head. Consult your reason. It is not infallible, but you will be less likely to err if you do so.

Electric Hoists for Power Plants.

The lifting and transporting of coal, ashes and other commodities in industrial plants which do not require the use of a heavy traveling crane, has been revolutionized to a great extent by the overhead trolley system equipped with an electric hoist. These systems have been found quite satisfactory in dealing with the lighter loads as is evidenced by their extended use.



A TWO-TON ELECTRIC HOIST.

In the accompanying illustration is shown the application of an overhead trolley system to the coal and ash handling problem in a new and modern street railway and electric lighting plant in the South. The lifting mechanism is a two-ton electric hoist manufactured by the Yale & Towne Manufacturing Co., New York City. This hoist operates on a motor-driven trolley as shown. The current is taken from the wires which run along either side of the I-beam track. The system as installed, in this particular plant, has proved very efficient.

Announcement of the 10th Annual Meeting of the Accountants' Association.

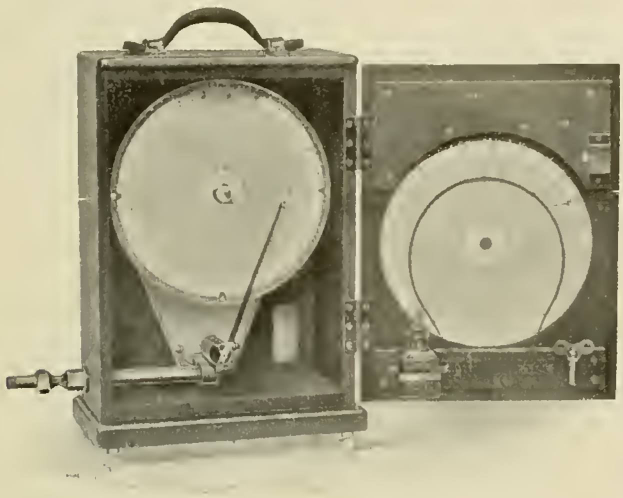
Secretary Elmer M. White, of the American Street & Interurban Railway Accountants' Association, has announced that the 10th annual convention of this association will be held in Columbus, O., during the week beginning Oct. 15, 1906.

There will be read a paper treating of the use of curves or the graphic method of showing results. This paper will be prepared by C. F. Bryant, auditor of the Connecticut Railway & Lighting Co., Bridgeport, Conn. P. S. Young, comptroller of the Public Service Corporation of New Jersey, will present a paper on the routine of construction accounts. The discussion of the subject of depreciation and appreciation as applied to electric railways will be lead by Robt. N. Wallis, treasurer of the Fitchburg & Leominster Street Railway Co., Fitchburg, Mass. This subject has been ready for discussion for several years and it is planned to make this effort the most comprehensive along certain lines that it is possible to do. The meeting, at which depreciation will be considered, will be open only to representatives of members presenting proper credentials.

A Portable Recording Pressure Gage.

The value of recording pressure gages as a factor in promoting safety and economy has long been recognized, and their adoption has been quite general in factories, water and gas works, electric lighting plants and power stations, both in this country and abroad. Many users have, however, felt the need of a light, compact and portable recording pressure gage, and particularly an instrument which is so well made and free from delicate mechanism that an ordinary workman can manipulate it successfully with reasonable care. To cover these requirements, The Bristol Co., Waterbury. Conn., has placed upon the market a modification of its well-known recording gage.

In these portable gages, the metal case has been omitted; the pressure tube and the clock for driving the chart being mounted on a light aluminum back which is in turn mounted in a wooden



THE BRISTOL PORTABLE RECORDING PRESSURE GAGE.

carrying-case designed with special reference to ease in handling and making connections to the source of pressure.

The gage is made in two types, one considerably heavier than the other. For recording pressures which may exceed five pounds per square inch, the heavier type is employed. A special flexible connection with unions, is supplied to facilitate connecting the gage to piping at various angles.

When a permanent installation is unnecessary, this instrument may be used to advantage, as, for example, on boiler tests, water mains or fire protective systems where a few accurate and continuous records will settle disputes or lead to better service.

For gas pressures in outlying districts, mine ventilating pressures, draft or light vacuum, the lighter type of gage is adapted, since it is capable of recording pressures as low as one-twentieth inch head of water. Connection is readily made by means of a rubber hose to a nipple, which projects through the side of the case. A simple clamping device is employed to hold the pressure tube rigidly, when the gage is being transported.

The portable gages just described weigh about one-third as much as the standard form gages mounted in a carrying-case, which has been used heretofore, as a substitute. Both forms are furnished with leveling screws to facilitate adjustment of the instrument. Provision is also made for carrying a supply of charts and ink with each gage.

Meeting of the Executive Committee of the Central Electric Railway Association.

At a meeting of the executive committee of the Central Electric Railway Association, held in the office of the secretary, 306 Traction Bldg., Indianapolis, Ind., on Tuesday evening, May 1st. Robt. W. Waite, vice-president and treasurer of the Louisville & Southern Indiana Traction Co., New Albany, Ind., was elected a member of the executive board of the association to fill the vacancy caused by the resignation of Mr. Gardner F. Wells. At this meeting, suitable resolutions were drawn up in memory of the late Jos. L. Breen, whose untimely death is noted elsewhere in this issue. The secretary announces that the next meeting of the association will be held at the Algonquin Hotel, Dayton, O., on Thursday, May 24th.

The Wapak Guy Anchor.

The accompanying illustrations show the Wapak guy anchor and its application to the use of guying trolley poles. These anchors are made in five sizes, but the one known as the No. 1½ has sufficient holding capacity for all ordinary strains on telephone and trolley poles. The installation of this anchor requires but a four-inch hole and it can be set by a workman in 20 minutes, without

THE GUY ANCHOR IN USE.

THE WAPAK GUY ANCHOR.

help. The only tool needed is a common auger with a five-foot handle.

There are several points of advantage in the use of this anchor. The blades naturally spread of their own weight when allowed to hang and assume their proper positions. They are so curved that they at once engage the sides of the hole in the ground and imbed themselves in the solid earth. Further, both blades are engaged in solid sub-soil and are not dependent upon the soil to be replaced in the hole for their bearing. After once being placed, it is impossible to tilt or slide this anchor or its blades. In the type of anchor mentioned as suitable for trolley poles, when the blades are extended 4½ in. into the sub-soil, they give a pulling surface against the immovable soil of 27 sq. in. It is claimed that these points have been proven by actual test and many engineers are specifying these anchors for their requirements.

The anchors are made by the Wapak Hollow Ware Co., Wapakoneta, O., for which company the W. R. Garton Co. of Chicago has recently taken the general sales agency.

New Headquarters for The Arnold Co.

The Arnold Co. has moved its Chicago office to the new headquarters which have been especially fitted up for it on the 16th and 17th floors of the Borland Building at the corner of La Salle and Monroe Sts. This building is one of the finest of Chicago's new skyscrapers. The company is issuing a very pleasing booklet illustrating the building and showing the 16th-floor plan of its new offices which have been arranged to conveniently accommodate the growing needs of the company. In addition, a suite of rooms has been obtained on the 17th floor for the accommodation of the architectural and structural steel department, which has recently been added to handle the building problems which arise in connection with the company's construction work.

The Conestoga Traction Co., Lancaster, Pa., is receiving excellent results from the practice, inaugurated several months ago, of removing and overhauling the armatures of car motors every 90 days. Before the armatures are again put into service, the shafts are trued up, new bearings are fitted and the commutators are ground down. A record is kept of the date each motor is put in service. When any motor has been run three months it is sent to the shops. Although the territory served by this company is very hilly, but little trouble is experienced from disabled motors.

The Toledo, Fostoria & Findlay Railway Co. recently issued a new passenger schedule which was effective on April 17th.

Products of the General Storage Battery Co.

The recent exhibit by the General Storage Battery Co. of its Bijur "high-duty" storage batteries at the Chicago Electric Trades Exposition was quite interesting as illustrating the substantial progress in this part of the electric railway field.

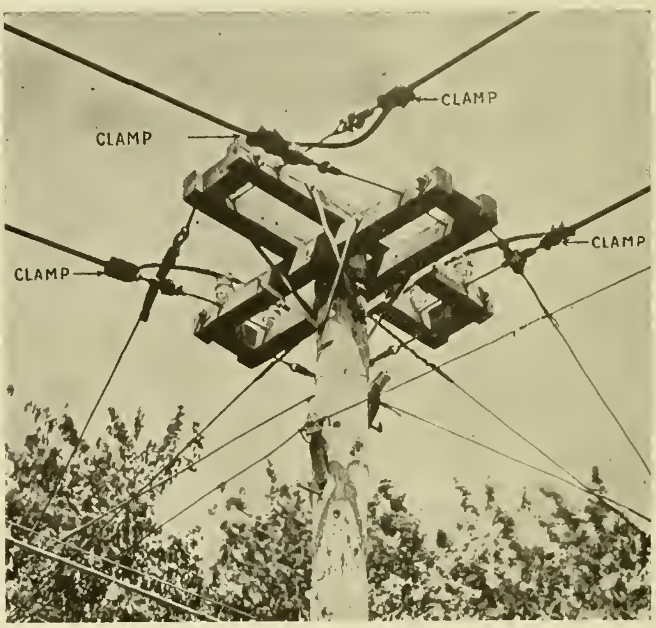
The exhibit was divided into 14 different groups. The various styles and uses of the batteries were exhibited and among these groups there may be mentioned one of a standard battery case for railway signals. This signal case contains two sets of five cells each of standard Bijur "high-duty" cells for railway signal work. Signal batteries are installed in duplicate in order that one set may be charged while the other set is operating on the signal system. The method of charging these batteries for this service, consists in connecting one set in each signal case over a distance of 18 to 20 miles, depending upon the spacing of signals in the single series, and charging all these sets so connected from a 500 or 600-volt generator.

The General Storage Battery Co. will also have elaborate exhibitions at the meeting of the National Electric Light Association at Atlantic City on June 5-8, 1906, and also at the Master Car Builders & Master Mechanics convention at Atlantic City on June 13-20, 1906. These exhibits will be on the same lines as the one in Chicago and will no doubt prove of considerable interest to the visitors at both conventions.

The Kearney Cable Clamp.

The accompanying view of a pole in use on the lines of the Topeka Railway Co., Topeka, Kan., illustrates the advantages to be obtained by the use of a cable clamp. The illustration shows two 500,000-c. m. cables turning a right angle. The saving in time and labor by the use of clamp construction will readily be apparent to those who deal with heavy power cables.

This device shown is known as the Kearney cable clamp, and the Topeka Railway Co. has used nearly 1,000 of them during the



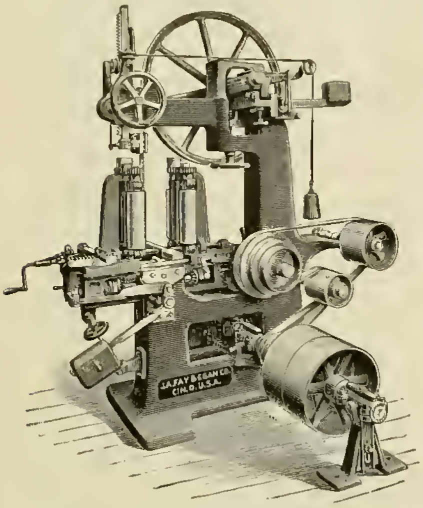
AN INTERESTING PIECE OF POLE TOP CONSTRUCTION.

past two years. The company has found that the cables can be put in position in much less time than is required with the old method of splicing the cable or placing strands around it. The final result, where these clamps are used, is an extremely neat and strong piece of line work. The Kearney cable clamp is manufactured by W. N. Matthews & Bro., 225 N. Second St., St. Louis, Mo.

According to the report of the Metropolitan West Side Elevated Railway Co., of Chicago, for the year ending Feb. 28, 1906, the gross receipts were $2,452,327, an increase of $291,386, and the net earnings were $1,279,897, an increase of $178,063.

A Modern Band Resaw.

The machine shown in the illustration is a new band resaw which is being placed on the market by the J. A. Fay & Egan Co., 250 Front St., Cincinnati, O. Although the resaw is sold as a machine of medium capacity, it is claimed by the makers that the construction and design are such as to allow almost twice the speed of the majority of similar types of machines.



A NEW BAND RESAW.

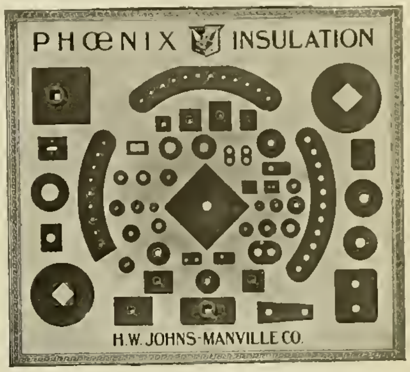
This new resaw is constructed throughout in a very durable and substantial manner and by reason of the heavy upright column, is able to resist all vibration. The company's patented straining device is fitted to the upper wheel which entirely protects the saw blades and keeps the tension uniform at all times. The feed rolls may be opened wide enough to receive material up to a thickness of 8 in. and a width of 24 in. The rolls are self-centering and are also fitted with a device for reducing thick lumber to panels in a quick and efficient manner. The machine is fitted with a quadrant which is gaged to eighths of an inch and assures close accuracy of work. The machine may be operated at three speeds of feed of 15, 30 and 50 ft. per minute, but on some work a much faster feed is permissible.

The economy and accuracy of this tool will be much appreciated in shops which do any considerable quantity of fine resawing. The company will be pleased to furnish catalogs upon application.

A Flexible Insulating Compound.

As a result of experiments which the H. W. Johns-Manville Co., 100 Williams St., New York City, has conducted for a number of years to perfect an insulating compound that can be worked into any desired form and still retain its insulating qualities, the company has succeeded in obtaining an insulating material which it claims will meet all the requirements. The new material is a Brown-Monarch compound and is known as the "Phoenix Insulation."

It is claimed by the company that this material combines all the properties of its well known "Vulcabeston" and "Moulded Mica" insulators, and also that it is able to withstand as high a degree of temperature as the former and is as impervious to moisture as the latter compound. The material has been thoroughly tested and it is said that it contains all the properties necessary for an insulation which can be used in connection with all types of electrical apparatus.

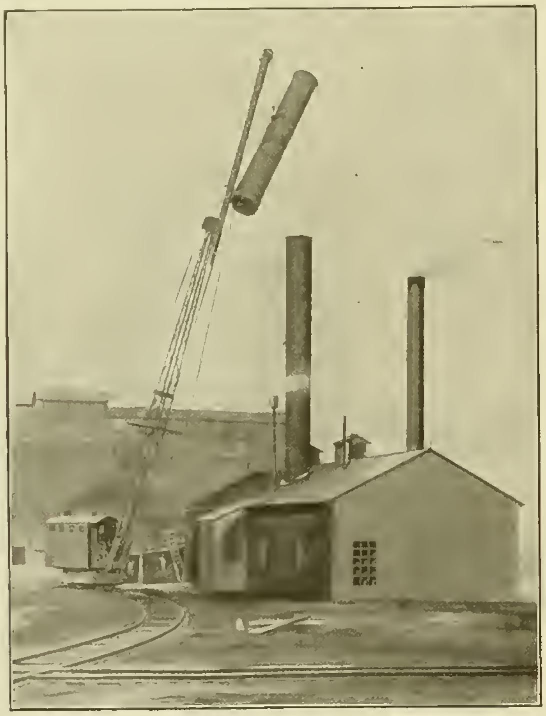


SOME FORMS OF PHOENIX INSULATION.

The accompanying illustration shows a few of the forms in which this material can be used. The compound has recently been placed on the market and the company reports that it is meeting with quite an extended sale.

The Locomotive Crane for Electric Railways.

The use of locomotive cranes and grab buckets has become quite general by many railroad companies in the United States and Canada as a simple and economical method for doing a variety of work. By substituting a hook block for the grab bucket, these cranes may be used for handling freight in the yards and for light wrecking purposes. Such cranes are usually built for service on a standard gage track, which allows them to be hauled great distances. If necessary, these cranes can do the switching of a number of loaded freight cars at one time as the draw-bar pull is equal to that of an ordinary yard locomotive.



A LOCOMOTIVE CRANE ERECTING A 100-FT. STACK.

The accompanying illustration shows a locomotive crane manufactured by the Browning Engineering Co., Cleveland, O. This is the company's No. 2 crane and is shown in the act of placing a 4½-ton section on top of a power house smoke stack at about a 25-ft. radius. The whole height of the completed stack is 100 ft. The long boom arrangement was fitted up specially for the occasion by tying a heavy 40-ft. timber to the 65-ft. iron boom and allowing 10 ft. for lap.

This novel use illustrates but one of the possibilities of a steam locomotive crane for handling heavy material. The company has issued a bulletin in which the uses of these locomotive cranes are described and illustrated at considerable length.

The petition of the motormen and conductors of the York Street Ry. and its suburban lines to the president and board of directors for an increase in wages, has been granted and took effect on Mar. 1, 1906.

The case of the city of Cleveland vs. the Cleveland Electric Railway Co., was decided by the Supreme Court of the United States in favor of the company. The case presented was a phase of the effort to force three-cent fares on the street railways of Cleveland.

A traction car has been specially fitted up by the Indiana Union Traction Co. for the use of Martin G. Mock, of Muncie, Ind., who has devised a novel method for the display of his curios and relics. Mr. Mock is reputed to have one of the largest and best collections in the country, some of the articles being of considerable value. The car will be fitted with cases and preparations are being completed for a trip over all the electric lines in Indiana and Ohio and stops will be made in the principal towns and cities along the various routes.

Spring Painting.

The Joseph Dixon Crucible Co., Jersey City, has recently issued a little pamphlet entitled "Spring Painting," which contains a number of seasonable thoughts. Attention is called to the fact that the costly structures which have everywhere been erected, are subject to rapid decay from the heat of the sun and the moisture of rains and snows, combined with the gases of combustion incident to manufacturing and transportation enterprises. Of the materials of construction metals and wood deteriorate most rapidly, but their lives may be prolonged by the intelligent use of a preservative coating. The economy of thus protecting valuable property against the forces of nature is pointed out.

The company is advertising a silica-graphite paint which, it is claimed, is admirably suited for use as a preservative coating. The graphite, which constitutes the body of the paint, is a silver gray ore found in the earth at Ticonderoga, N. Y. This paint has been in use in all climates over an extended period of years and the results obtained from it are said to be very satisfactory.

The New Power House of the Pennsylvania Traction Co., Harrisburg, Pa.

The days of temporary construction of power stations, car storage barns and machine shops for electric railway purposes have for the most part passed. The practice in many cases now seems to tend toward the other extreme, with the result that buildings are now not only planned with sufficient room for existing conditions, but are also built with a view to new machine installations which may be needed as the property is extended. The Central Pennsylvania Traction Co., of Harrisburg, Pa., in the building of its new power house on Cameron St., Harrisburg, is keeping apace with the advanced methods for such construction. This plant will compare favorably with the majority of similar plants in the state of Pennsylvania.

The building occupies a space of 102 x 175 ft. and is 40 ft. high. It has been constructed entirely of steel and concrete, the concrete being used for the walls between the steel columns and also for the floors in the building.

The boiler room, which is located at the rear of the building, is 45 ft. wide and extends the length of the building. It contains a battery of five 350-h.p., horizontal, water-tube boilers. Overhead coal bins are to be installed and also ash and coal handling elevators of the chain-bucket type. The ash bin is to be located overhead in the central part of the structure, to which the ash will be carried by means of the elevators from the pits which are located 11 ft. below the boiler room floor.

A reinforced concrete stack has been built which is 210 ft. high, with an inside diameter of 10 ft. The stack rests on a solid rock foundation extending 20 ft. below the surface of the ground. It is proposed to build switches from the Pennsylvania and the Philadelphia & Reading railways to the plant to facilitate the delivery of coal.

The engine room, which is 50 x 170 ft. in area, occupies the front part of the building and faces on Cameron St. The equipment will consist of three horizontal, cross compound corliss engines. Each engine is to be direct connected to a 650-kw., 600-volt direct-current generator mounted on the main shaft. These engines are to be capable of running at 50 per cent overload for short periods, thus giving the plant a maximum capacity of 4,500 h.p. This equipment is being furnished by the Allis-Chalmers Co., and while it is very complete and is of sufficient capacity to generate the power required for the present, there will be used only about one-half of the floor space, the balance being reserved for future installations.

According to the present plans the water is to be obtained from the Susquehanna River through a 5-ft. tunnel, which is drilled through the rock at a distance of 30 ft. below the surface of the ground and extends from the plant to the river bank. At this point it will connect with a large cast-iron pipe extending into the river for a considerable distance, so that comparatively pure water can be obtained for the boilers. It is expected that the plant will be ready for operation by June next. The old power station which is located on property adjoining that of the new building, will be kept intact until the new equipment has been given a thorough test.

STREET RAILWAY REVIEW

Vol. XVI JUNE, 1906 No. 6

The Southern Michigan Railway Co.

The Southern Michigan Railway Co. was organized on Feb. 8, 1906, by the consolidation of the South Bend & Southern Michigan Railway Co., and the Niles & Buchanan Railway Co. The electric railway property recently put in operation by the new company extends from Niles to St. Joseph, Mich. The interurban line between South Bend, Ind., and Niles, Mich, has been in operation some two years and with the organization of the Southern Michigan Railway Co. the new and the old lines were united, so that now the property includes a well built interurban line 35 miles long, traversing the "fruit belt" in the southwestern part of the lower peninsula of Michigan. The same company has in process of construction an interurban line from Niles to Buchanan, Mich.

The entire route over which the cars of this road operate is 35 miles long. The larger amount of passenger traffic will be furnished by the cities of South Bend, the southern terminus, St. Joseph, the northern terminus, Niles, situated about one-quarter of the entire length of the route north of South Bend and Berrien Springs, situated a like distance south of St. Joseph. Trackage rights have been obtained in the two terminal cities so that the interurban cars have excellent terminal facilities. In St. Joseph the interurban cars operate over the tracks of the St. Joseph & Benton Harbor Electric Light & Railway Co. for a distance of about 4,000 ft. This portion of the route is double-tracked. The private right of way of the interurban line extends to within one-half mile of the terminal station at South Bend.

Other than the usual traffic to be had from the substantial cities along the route, the management of this road expects to enjoy the patronage of the especially large summer population which centers at St. Joseph and Berrien Springs. It is interesting to note that there are one or more summer resorts within easy walking distance of each of the regular interurban stops between Niles and St. Joseph. The route for a large proportion of the distance, parallels the St. Joseph River along which there are many summer hotels and boarding houses.

It is expected that through tickets from South Bend to Chicago by the way of St. Joseph and the Graham & Morton steamship line can be sold at somewhat lower rates than the steam railroads charge for transportation between South Bend and Chicago.

The northern half of the route bi-sects the well-known Michigan "fruit belt" and will afford transportation facilities of easy access for the large amount of freight traffic which originates in this territory each fall. Last year 17,000 cars of fruit were shipped over the steam roads occupying this territory and it is only to be expected that the accessibility to the interurban route will bring the electric line a large proportion of the traffic originating in its territory. Preparations are being made for suitable electric locomotives and other equipment which will be used to handle the refrigerator cars used in transporting the fruit.

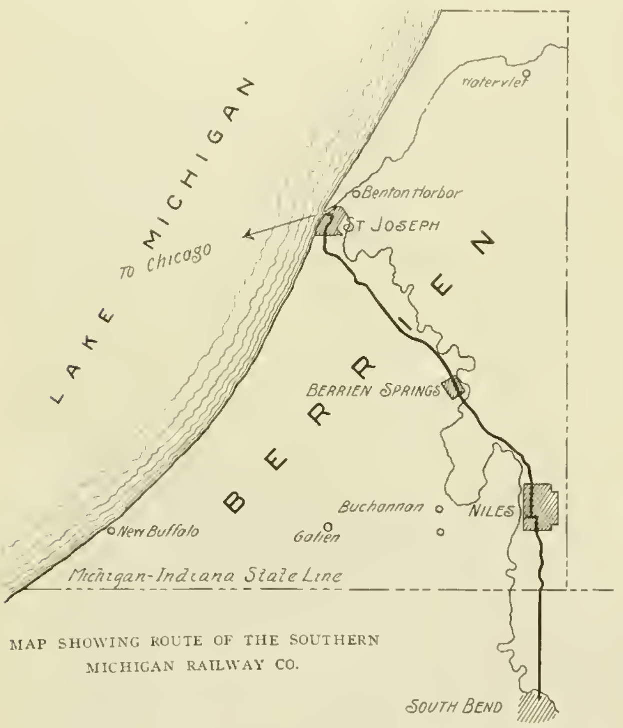
BRIDGE OVER THE ST. JOSEPH RIVER AT BERRIEN SPRINGS. EIGHT 150-FT. THROUGH TRUSSES ON CONCRETE PIERS.

Road-Bed and Track.

The southern terminus of the interurban route is the South Bend passenger station of the Northern Indiana Railway Co. From here for a distance of about half a mile the interurban cars

operate over the double tracks of the South Bend city system.

The right of way from South Bend to Niles parallels a branch of the Michigan Central R. R. and is practically straight for the entire distance with the exception of two curves at the viaduct where the electric road crosses the steam roads elsewhere mentioned. From Niles north to St. Joseph the right of way parallels the river valley and a large amount of heavy filling was necessary. There are a number of cuts and fills 30 to 40 ft. deep, but enough grading was done to furnish a low grade line with



MAP SHOWING ROUTE OF THE SOUTHERN MICHIGAN RAILWAY CO.

easy curves. The right of way is enclosed for the entire length of the line by two woven wire fences. The construction of this fence varies from the usual type in that the woven wire is carried to a point about six inches below the tops of the fence posts and has above it a single wire which is twisted and constantly under strain, thus remaining taut and protecting the top wire of the fencing. Cattle guards and wing fences have been erected at all highways and farm crossings and the wing fences are white-washed. The part of the roadbed from South Bend to Niles has been in operation for some two years and is so constructed that the cars may safely be operated at high speeds.

The general surface of the country between South Bend and Niles is flat, and as the sub-soil is of a light nature the waterways are deep and have steep banks. Such features necessitate expensive bridge work and the accompanying illustrations of a few of the structures along the line will serve to show that this company has built the roadbed very thoroughly. With the exception of the long steel spans all of the waterways have been crossed with concrete boxes or arches, some of which are illustrated herewith. In constructing some of these concrete arches serious engineering difficulties were encountered.

About four miles south of St. Joseph it was necessary to build a 20-ft. fill several hundred feet long. Near the center of this fill a small stream was crossed by a reinforced concrete arch culvert of substantial design. After the culvert had been completed and the fill was nearly up to grade a general sinking of the roadway was noticed. The grade subsidence of the road-bed continued as fast as more earth was placed and during one night a large part of the road-bed sunk several feet into the marsh. At this time the roof of the concrete culvert was broken down and the entire fill about it settled. The accompanying illustration of the destroyed culvert will serve to show how general must have been the sinking since the two ends with their wing walls remained at their original elevation while the middle portion of the structure was carried down several feet. There has since been deposited on this fill a large amount of earth and it is now thought that the bottom of the fill has reached the clay bed which is known to be under the marsh. As a temporary crossing the wooden deck truss shown in the illustration has been erected and is carefully watched for any further sinking.

At Berrien Springs the roadway crosses the St. Joseph River. At this point the river is shallow and very wide with high banks. Just below this crossing engineering work is under way for the construction of a 20-ft. dam which fact necessitated the building of the electric railway bridge at an elevation so high that sufficient clearance would be afforded after the waters of the river have been raised by the dam. The extensive bridge structure which was built at this point consists of eight through trusses, each of 150-ft. span. The piers and abutments for these spans are concrete monoliths resting on firm foundations below the bed of the river. The entire bridge with its approaches is 1,635 ft. long and the rails of the track are 60 ft. above the present mean water level. The high-tension pole line is carried across the river on short lengths of cedar poles clamped to the vertical hangers of the bridge spans. The trolley wire through the bridge is flexibly supported by short spans of steel cable.

Near the northern end of the city route in South Bend the line crosses the St. Joseph River at a location that at construction time already was occupied by a substantial highway bridge. In order that there might be no interference with the traffic on the city bridge an additional narrow section supported by a new truss and the western truss of the existing bridge, was erected. An accompanying illustration shows the completed bridge and the details of the floor in the part used by the interurban cars.

There is but one grade crossing with a steam road and this is with a side-track which is used during but a small portion of the year. At all other railroad crossings the grades have been separated either by subways or viaducts. One of the illustrations shows the unique crossing situation near Niles. At this point the right of way of the electric road intersects the lines of two steam railroads whose rights of way also intersect at this common point. At this crossing the track of the Cleveland, Cincinnati, Chicago & St. Louis R. R. is depressed below the general surface. Over this track the single track of the Michigan Central R. R. crosses with a span at an elevation a few feet above the general level of the ground. The electric railway viaduct is built at an elevation of 60 ft. above that of the lower steam track and has long earthwork approaches built on a grade of about 3½ per cent. Plans are under way for lengthening these approaches so that the grade of the electric track will be reduced to 1½ per cent.

The road-bed has been built for a single track. This track is located at the proper distance off the center of the right of way which will permit of a future second track being built on the

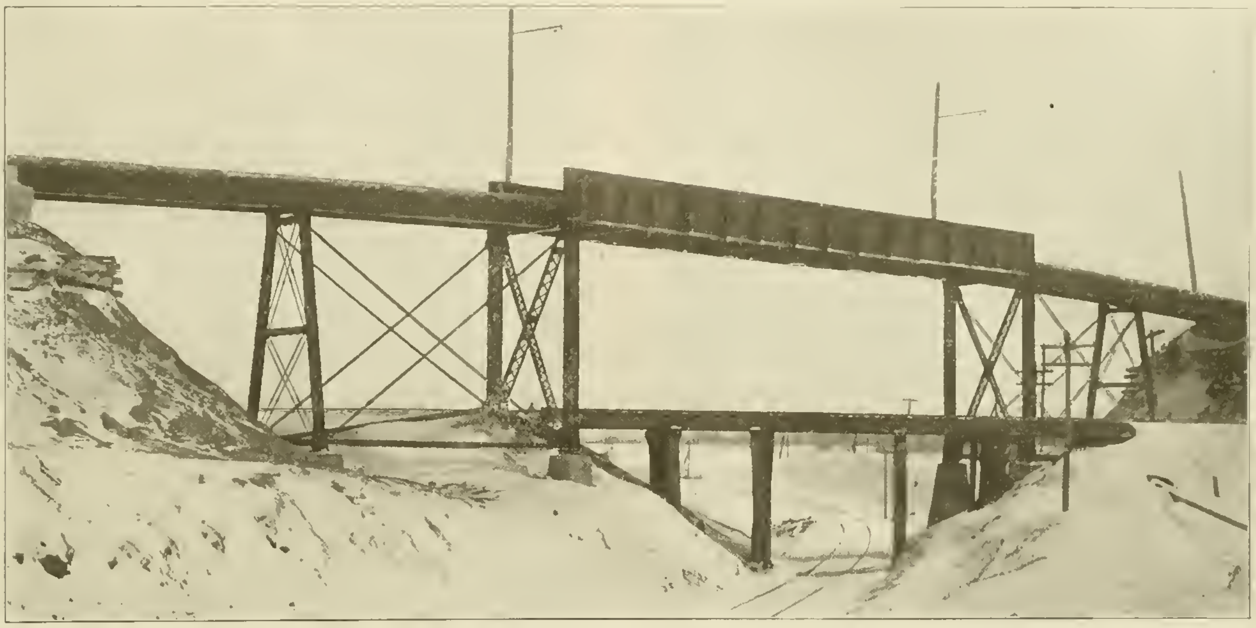
SOUTHERN MICHIGAN RAILWAY CO. BRIDGE AT SOUTH BEND SHOWING NARROW SECTION ADDED FOR ELECTRIC TRACK.

opposite side of the right of way center line. Cedar ties are used with tie-plates on all curves. The track is laid with 70-lb. rails connected by four-hole angle-bars. The rails are electrically joined by one No. 0000 pin-driven bond at each joint. When the special work is completed there will be 16 double-end turnouts with spring switches. These switches have high stands with two-position semaphore arms and oil signal lights. As a safety precaution a cluster of five incandescent lamps with a hood is sup-

ported on a bracket over each switch stand. These lights are fed from the trolley and always kept burning so that if from any cause the switch light should go out, the light from the burning cluster will illuminate the semaphore arms on the switch stand and the switch point in the track.

Schedules.

In the 35 miles of route there are 65 regular stopping points for the interurban cars. Each stopping point is indicated by a red band painted around a trolley pole. At present there are no stations outside of the cities. The cars were first put in operation May 21st and a regular hourly schedule has been maintained with no interruptions since that date. The running time for the 35 miles between the two terminal station buildings is 85 minutes. This necessitates comparatively high speeds in the country, since it is necessary to run slowly through the streets of South Bend, Niles and St. Joseph and since there is an average of 35 stops per trip. A telephone line has not yet been installed, so that there is no dispatching system. It is therefore necessary to have positive meeting points and operate by time card. To assist in the keeping of the cars on the scheduled time the superintendent of transportation has issued an instruction card showing the schedule time at each station and siding. This card also bears a number of instructions regarding the classification of cars and the operating of trains in sections.



THE SOUTHERN MICHIGAN RAILWAY CO. VIADUCT OVER MICHIGAN CENTRAL R. R. AND CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS R. R.

SOUTHERN MICHIGAN RAILWAY CO. STANDARD TYPE OF SPAN BRIDGE.

SOUTHERN MICHIGAN RAILWAY CO. STANDARD CONCRETE CULVERT.

The regular fare for the ride from South Bend to St. Joseph, a distance of 35 miles, is 65 cents. The route is divided into five-cent limits which make the fare at the rate of about two cents per mile. Round-trip tickets are sold at a slight reduction below the regular fare. Such tickets are only sold at points where there are ticket offices.

Rolling Stock.

The passenger rolling stock includes 10, 52-ft. interurban cars of the type illustrated. These cars are 8 ft. 8 in. wide and 12 ft. high from the rails to the trolley board. As a large proportion of the passengers handled consists of women, children and excursionists, it was not thought wise to set apart any portion of the car as a smoking compartment. A toilet compartment is provided in one corner of the car. The interior finish of the car body is plain mahogany and the exterior is painted a light yellow. Each car has seats of the walkover type with a capacity for 54 passengers.

The cars are each mounted on two St. Louis Car Co's. trucks with 34-in. steel-tired wheels and 5½-in. hammered-iron axles. There are two GE No. 74 motors on each truck with solid gears having a ratio of 22 to 67. The cars are equipped for double-end operation with the Sprague-General Electric, type M, multiple-unit control.

The additional rolling stock consists of a Peckham rotary snow plow and one 52-ft. baggage and express car which is leased from the Northern Indiana Railway Co. Additional express cars of the style shown in the accompanying illustration will be purchased as the traffic increases.

At present the rolling stock is inspected and repaired at the shops of the Northern Indiana Railway Co. in South Bend, but there soon will be completed a repair shop adjoining the power station at Scotdale. This shop will have three pit tracks with a total capacity for repairing three cars under cover.

STANDARD PASSENGER CAR SOUTHERN MICHIGAN RAILWAY CO.

Power House and Distribution System.

Current for the operation of the rolling stock is obtained from two sources. At the southern end of the route the direct-current trolley and feeders are connected with the overhead system of the Northern Indiana Railway Co. The source of the current used throughout the larger portion of the route is generated in a new power house at Scotdale. At this station, which is about eight miles from St. Joseph, the northern terminus of the route, a power house and shop building has been erected adjacent to the right of way.

The new building is of frame construction with corrugated iron sheeting. The building foundations and those of all the machinery piers rest upon a concrete monolith 22 in. thick and of an area enclosed by the exterior building walls. This type of construction was deemed necessary on account of the sandy nature of the sub-soil.

VIEW OF A TEMPORARY WOODEN SPAN OVER A BREAK IN THE GRADE AT THE SINK HOLE, SHOWING FRACTURED CONCRETE CULVERT.

Coal for the operation of the plant may be brought to the storage bunkers either on the tracks of the Pere Marquette R. R. or the electric line. The storage bunker extends across the east end of the power house. The steam railroad siding is close to the coal storage shed and at an elevation 35 ft. higher than the floor of the boiler room. By means of gravity chutes the coal, as it is shoveled from the steam railroad cars, is led to the proper storage place in the shed from where it may be allowed to fall on the boiler room floor in front of the firing doors.

There are three Matthews fire-tube boilers, each of 300-h. p. rated capacity. The boiler house is of sufficient size to accommodate a fourth similar unit. Draft is furnished by a steel stack 6 ft. in diameter and 60 ft. high. The large flues and breeching are of brick work. From a header in the boiler house steam is led through separators to the main engines in the adjoining part of the building. In the engine room there are two independent generating sets consisting of a 28x54-in. horizontal, corliss-valve engine belted to a 500-kw. capacity, direct-current generator and a 24x48-in. horizontal, corliss engine belted to a 300-kw. capacity railway generator. As no condenser equipment is provided a portion of the exhaust from the engines is used in heating the boiler feed-water. A 16-in. spiral-riveted, free-exhaust pipe is connected with the heater and exhaust tank through a back-pressure valve. The heater equipment and the auxiliary pumps are located between the boiler settings near the center of the boiler room. The journals of the engines are served by a gravity-lubricating and oil-purifying system.

TYPE OF BAGGAGE AND EXPRESS CAR TO BE USED ON THE SOUTHERN MICHIGAN RY.

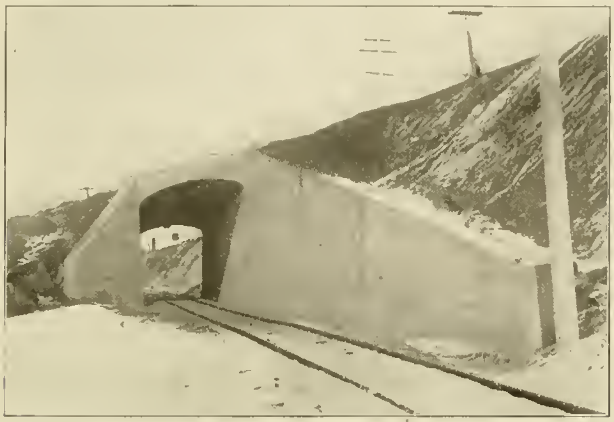
In addition to direct-current generators driven by the engines there is a 300-kw. rotary converter which at present is used to convert direct current taken from the generator busses to alternating current for feeding a sub-station at Niles. The two generators and the rotary converter are controlled from a simple switchboard which stands between the rotary converter and the engines. It is interesting to note that with this power station equipment and but one sub-station in operation it is not necessary to use any alternating current switching devices.

VIEW OF THE TOP OF THE BROKEN CULVERT AT THE SINK HOLE.

The switchboard has four panels; one supports the alternating-current measuring instruments, two are direct-current generator panels and a fourth panel is for the control of the direct-current end of the rotary converter. In the near future the board will

be lengthened by the addition of two direct-current feeder panels and until these are placed it is necessary to control the trolley feeders with the machine circuit breakers. A bracket volt-meter serves to indicate the difference of potential between the direct-current bus-bars.

From the slip rings on the rotary converter three-phase, alternating current is led to three oil-cooled transformers which step



SOUTHERN MICHIGAN RAILWAY CO. CONCRETE UNDER-CROSSING WITH THE MICHIGAN CENTRAL R. R.

up the pressure to 19,100 volts for transmission to the sub-station, 17½ miles distant. The high potential wires from the secondary side of the transformers are mounted on standard line insulators carried on a hardwood rack. From this rack the wires pass to the gable of the roof and out through the end wall of the building to the transmission line on the poles. A bank of lightning arresters is mounted on the end wall immediately under the outgoing wires.

The high-tension transmission line consists of three No. 4 hard-drawn copper wires mounted at the top of the trolley poles. These wires are arranged in the form of a triangle 34 in. on a side. As

SUB-STATION AT NILES COVERING GROUND SPACE OF 16 x 18 FT. TRANSFORMERS ON SECOND FLOOR.

only one circuit is carried on this pole line the upper wire has its insulators set on pole-top pins. The two lower wires are carried at the ends of a standard cross arm.

The sub-station is located at the rear of the interurban office and waiting room in Niles. As this location is near the center of the city and real estate here has a comparatively high value, an interesting interior sub-station arrangement was used to economize ground area. The sub-station building is of brick and concrete-steel construction with a floor area of but 14x16 ft. The building is two stories high and of a plain design. The high-tension wires enter the upper story of the building through wall insulators and there connect with lightning arresters and hand-

GENERAL VIEW OF POWER STATION AND CAR SHED.

throw, cut-out switches. The lower sides of the cut-out switches are connected with the primary coils of three oil-cooled step-down transformers which occupy practically all of the floor space of the second story. A 300-kw. rotary converter is installed on the ground floor. There is also on this floor a switchboard having panels for controlling the rotary and the outgoing feeders.

The pole line for the entire distance of the road has 35-ft. Michigan cedar poles in the country and 60 and 75-ft. Idaho cedar poles

SOUTHERN MICHIGAN RAILWAY CO. STANDARD TRACK AND OVERHEAD CONSTRUCTION.

through the towns where any lower form of construction would endanger the high-tension wires. No. 000 grooved trolley is supported by clinch ears and Ohio Brass Co. standard overhead fittings. For straight line construction 12-in. ears of the clinch type are used. On curves the trolley is supported by similar ears eight inches long. Flexible suspension brackets are used on straight

track with span construction at curves. Along the entire length of the line the trolley wire is supplemented by a 300,000-c. m. bare copper feeder.

The officers of the Southern Michigan Railway Co. are: Mortimer P. Reed, president; William W. Babcock, vice-president; James B. McCance, secretary; F. W. Bueltzingslowen, treasurer; J. McM. Smith, general manager: Charles G. Lohman, superintendent of transportation; E. L. Critchlow, general freight and passenger agent, and H. M. Ashenfelter, superintendent of motive power.

May Meeting of the Central Electric Railway Association.

The May meeting of the Central Electric Railway Association was held at the Algonquin Hotel, Dayton, O., on May 24th. The program as previously announced by the secretary was closely followed. This meeting was an especially interesting one from an interurban standpoint on account of the presence of representatives of so many widely distributed properties. A large proportion of the attending members traveled to Dayton on special cars. It is interesting to note that electric railway clearances and road-bed construction have been so standardized that special cars can make journeys of over 200 miles at a rapid rate over the tracks of five or more different companies.

Among the special cars which were run for the benefit of attending association members, were the "Lawton" of the Ft. Wayne & Wabash Valley Traction Co., which carried a large delegation from the northern part of Indiana; the special car of the Indianapolis, Columbus & Southern, which carried a party of 25 from Indianapolis and central Indiana, and the special tourist car "Yolande," of the Detroit United Ry., which carried a party of Detroit United officials, their wives and a number of the press representatives from the larger cities between Detroit and Dayton. No effort was made to run the Yolande at a high rate of speed, as the trip had been planned for the purpose of inspection and pleasure.

The meeting was called to order at 10:30 a. m. with President Spring presiding. Before the regular program opened Mr. W. De M. Hooper, president of the Hooper-Holmes Information Bureau, 87 Nassau St., New York City, spoke regarding improved methods for handling accident claims.

Mr. H. C. Moore, treasurer of the Pittman-Myers Co., Indianapolis, Ind., described a new emergency box which is being supplied for interurban cars. This box is intended to be hung in one corner of the car to serve as a first aid in case of accidents, the crew being instructed in the use of the various materials and medicines packed in it. In each box will be found among other things, antiseptic tablets for cleansing wounds, six 10-yard rolls of bandage, salve put up in tablets for burns and bruises, safety pins to fasten bandages, and complete printed directions for first aid to the injured. In these printed directions the various articles in the box are referred to by number and each article is tagged with its particular number so that there may be no error or delay in finding the right article.

At the request of the president, Secretary Merrill read the report of the March meeting of the association, which was held at Indianapolis, as reported in the "Street Railway Review" for April, page 190.

President Spring announced that local committees consisting of the following members of the association would hereafter keep the officers of the association in closer touch with local affairs:

Cleveland; J. O. Wilson, secretary and treasurer Cleveland & Southwestern Traction Co., F. W. Coen, secretary Lake Shore Electric Railway Co., Cleveland, Chas. A. Kenworthy, superintendent Electric Package Co., Cleveland.

Toledo; E. Darrow, general manager Toledo & Indiana Electric Railway Co., Toledo, C. T. Chapman, assistant general passenger and freight agent Toledo & Western Railway Co., Toledo, C. N. Hawley, auditor Toledo, Port Clinton & Lake Side Ry. Co., Toledo.

Findlay; Chas. F. Smith, general manager Toledo Urban & Interurban Railway Co., F. W. Adams, general manager Toledo, Fostoria & Findlay Traction Co., E. H. McKnight, general manager Lake Erie, Bowling Green & Napoleon Railway Co.

Lima; C. C. Collins, general freight agent Western Ohio Railway Co., H. F. Dickie, superintendent Lima & Toledo Traction Co.

Fort Wayne: W. T. Shelton, superintendent transportation Ft. Wayne & Wabash Valley Traction Co., W. H. Fledderjohann, president and general manager Ft. Wayne & Springfield Railway Co.

Indianapolis; Frank D. Norviel, assistant general passenger and freight agent Indiana Properties, A. A. Anderson, general superintendent Indianapolis & Cincinnati Traction Co., W. G. Irwin, vice-president Indianapolis, Columbus & Southern Traction Co.

Dayton; Valentine Winters, president, Dayton & Western Traction Co., John F. Ohmer, president Ohmer Fare Register Co., Dayton, F. J. Ferneding, superintendent, Dayton & Xenia Transit Co.

Columbus; Geo. Whysall, general manager, Columbus, Delaware & Marion Traction Co. L. C. Bradley, superintendent, Scioto Valley Traction Co. E. J. Davis, traffic manager, Columbus, Buckeye Lake & Newark Traction Co.

Cincinnati; F. J. J. Sloat, general manager, Cincinnati Northern Traction Co. C. E. Hooven, general manager, Cincinnati, Lawrenceburg & Aurora Traction Co.

Canton; J. R. Harrigan, general manager, Canton-Akron Railway Co.

Youngstown; C. J. A. Paul, general manager, Youngstown & Sharon Traction Co., J. W. Brown, superintendent of transportation, West Penn Railways Co.

The chair announced that Mr. A. L. Neereamer, traffic manager of the Columbus, Delaware & Marion Railway Co., had been appointed as an additional member of the transportation committee.

The president asked for more ready response to requests for information to be used in the secretary's office. He commended the association for the good work its representatives have done in the state legislative affairs.

It was announced that no more meetings would be held until September, when it is planned to have the annual association outing at some convenient resort.

Messrs. E. L. Hamilton, George S. Budd and E. Stacey, secretaries of the railroad department of the Young Men's Christian Association, described in an interesting way and illustrated by the use of a stereopticon the great work which the Y. M. C. A. is doing toward bettering the morals of railway employes throughout the country. There are now 212 railway associations with a total of 85,000 members During the past year the railroads contributed to the cause $260,000 and the men paid in dues $340,000. A model building for such an association as could be formed on a large electric railway property would have in its basement a bath, toilet rooms, lockers and a barber shop; on the first floor, the secretary's office, a general reading and social room and a lunch room which would be open at all times; on the second floor would be the educational department with rooms for study and instruction. The third floor would be fitted up for sleeping quarters for members.

About four years ago the railway department of the Y. M. C. A., through the help of the Rochester Railway Co., organized the first electric branch of its association. The Rochester Railway Co. fitted up rooms in one of its buildings, the value of which after two years of occupation by the employes was so evident that a second branch was organized. The speakers stated that the management of the Rochester property is especially enthusiastic regarding the betterment of the service which the Y. M. C. A. has brought about.

President Spring next read a paper prepared by J. W. Brown. (This paper will be found on page 313.)

In discussing the various methods for increasing summer travel, President Spring stated that the Dayton, Troy & Piqua management encourages the establishing of summer camps along the line of the interurban routes. This practice has been found satisfactory and many cottages have been built on the river bank which is paralleled by the interurban right of way.

At the request of the executive committee, Henry N. Staats, manager of the Associated Railway & Light Companies' Insurance, Inspection & Survey Bureau, discussed the object of the formation of mutual insurance companies, by which means it is thought that the risks of the various traction properties can be carried at cost.

Mr. Staats introduced his remarks by saying that the plans of the company which he represents have been approved by the insurance committee of the American Street & Interurban Railway Association. The methods by which it is proposed to organize the mutual traction insurance companies were described in the "Street Railway Review" for September, 1904, page 600, and for November, 1905, page 803. Mr. Staats said that four insurance companies

have been incorporated in Ohio and that their engineers are now prepared to show how insurance can be carried at very low rates. The entire capital stock of these companies will be contributed by those interested in the railway and light properties and after paying the actual loss and operating expenses all unused premiums will be returned to the policy holders. This method of management should reduce insurance to a proper actual cost. Mr. Staats stated that four of the strongest old-line insurance companies had approached him and agreed to co-operate with the traction companies in carrying their risks at reduced rates. The speaker stated that by the 20th of June the new organization with a capital stock of $200,000 and a surplus of $300,000 will be ready to write a $50,000 policy on each of the properties represented and guarantee these policies with its capital stock and surplus of $500,000.

Mr. J. R. Replogle, superintendent of the Cambria Steel Co., presented a paper on "Axles for Interurban Cars," dividing his subject into four sub-heads: (a) "Steel vs. Iron Axles"; (b) "Forged vs. Cold Rolled Axles"; (c) "Broken Axles"; (d) "Specifications." He said that experience has demonstrated that steel is superior to iron for car axles because of its greater tensile strength, longer life under varying loads causing fatigue, and its better wearing properties. The speaker cited tests made by the United States government and by Mr. Wohler, chief engineer of the Prussian State Railway.

He said that cold-rolled axles have been extensively used but have proven unsatisfactory and greatly inferior to "Coffin Process" axles. He described various tests made by the Cambria company which demonstrated clearly the inferiority of the cold-rolled axles.

In regard to broken axles, Mr. Replogle said that they were generally due to the fact that the steel used was too low in carbon, lacking elasticity, and that the breaks were generally in the form of a "detail fracture," showing "fatigue" of metal. Experience has shown that where the tensile strength of the steel has been increased the danger from broken axles has been largely eliminated.

Mr. Replogle thought that all axles should be purchased subject to a chemical and physical test and recommended the following specifications:

Carbon	.35 to .5 per cent
Manganese, not over	.6 per cent
Phosphorous, not over	.05 per cent
Sulphur, not over	.06 per cent
Elastic Limit, not less than	50 per cent of tensile strength
Ultimate Strength, not less than	30,000 lb. per sq. in
Elongation, not less than	20 per cent in 2 in.
Reduction of Area, not less than	40 per cent

The remaining portion of the afternoon session was devoted to the discussion of the various subjects as announced in the program. In this discussion many interesting operating features were described.

F. J. J. Sloat of the Cincinnati Northern Traction Co., discussing the topic of "Lost Articles," stated that on his property the conductors are supplied with suitable tags that may be tied to lost articles. With an article so tagged it is sent to the superintendent, who makes a memorandum including the date of the finding, car number and the conductor's name and number. Such cards are kept on file and if after six months' time the article has not been claimed it is given to the conductor who found it. This method of handling lost articles requires very little attention from the management. A large proportion of the lost articles found are turned in.

Charles Kenworth, general manager of the Electric Package Co., Cleveland, O., introduced the discussion on the sealing of milk cans. Mr. Kenworth stated that the associated interurban lines in and around Cleveland handle about 1,200 cans of milk per day and that he believes the sealing of these cans is not necessary. He thought that there would be several inconveniences if it were required that all filled milk cans be sealed. It is necessary for the health department to have access at all times to any can of milk entering the city of Cleveland. It is also desirable that the freight department of the various lines have ready access to the cans, as it has been found that some shippers bill cream at the milk rate or extract the water from the milk before shipment and add it before distributing it to the city customers.

The discussion on the best method for inspecting motors for low bearings was opened by A. A. Anderson of the Indianapolis & Cincinnati Traction Co. Mr. Anderson stated that some motors were supplied with hand holes in their frames so that shims of various sizes can be inserted between the pole pieces and the armature binding. Other motors have peep holes which are in line with the circumference of the armature and permit of visual inspection when a lamp is held at the opposite end of the frame from the eye of the inspector.

C. N. Wilcoxson of the Cleveland & Southwestern suggested that more rigid inspection be made and a systematic plan adopted for keeping record of low bearings.

P. J. Mitten, Indiana Union Traction Co., suggested that the best method for preventing low bearings is frequent inspection and close attention to maintaining a proper supply of lubrication in the armature journals.

C. Clark of the Muncie, Hartford & Fort Wayne Ry. stated that the motors on that line were inspected and clearances taken each day. As a result of this practice the company has not lost a single armature from low bearings in two years. Both the peep hole and the shim methods are used.

The next subject, "What style of trolley ear do you recommend and what are the points of advantage of the clinch, semi-clinch and soldered ears," was first discussed by E. F. Wickwire of the Ohio Brass Co. He stated that the quality of the metal of which the overhead material is manufactured should be high. Care should be taken that ears are not cast from a mixture containing a large per cent of scrap. Such a mixture will not be homogeneous and while many of the ears may be good, there is apt to be a portion of them which will be brittle. It is hard to state any definite standards for the length of ears, as the manufacturers find that no two roads desire the same dimensions. Some purchasers specify that the overhead fittings shall be of bronze, but the speaker thought that a mixture called "brass-bronze" would give better results. Such a combination of metals is tough and ductile. Of the various metals used in ear manufacture bronze is the most popular, yet very good results have been obtained with malleable fittings. Short ears have been criticized on account of the tendency of causing kinks in the trolley wire. The speaker said that the average general practice is to use 15-in. ears for round wire, these ears being of the clinch or clamp type, and not soldered. With the grooved trolley wire a 12-in. mechanical ear is preferred. A large proportion of the roads have ears soldered on the curves.

L. J. Schlesinger of the Muncie, Hartford & Fort Wayne Traction Co. said that the trolley wire on his road is supported by both clinch and clamp ears. Good results have been obtained from the use of the clinch ears and if the trolley wire is maintained tight no trouble need be expected from kinks at the short ears.

F. J. J. Sloat introduced the subject of "What is the best method of handling employes' transportation," stating that it is a hard problem to solve in a satisfactory manner. He thought it the best plan to issue employes' transportation so that a conductor can have something to give the auditing department for every passenger that his car carries. The hardest part of the problem is to arrange a satisfactory scheme for furnishing tickets to section men. The method adopted on the Cincinnati Northern lines is practically that which is used on the lines of the Indiana Union Traction Co. Each foreman is given a conductor's punch and a number of tickets which he can make usable by properly punching as needed. The superintendent also carries a punch and supply of tickets which can be issued in case of emergency. The employes who ride over a definite portion of the road each day of the month are given 60-ride books.

A. A. Anderson stated that on the Indianapolis & Cincinnati Traction Co's. lines all subordinate officers are given card passes. Conductors take receipts when passes are shown and register these receipts on the ticket dial of the fare register. Men employed in the power houses and shops can obtain transportation only by making written application to the superintendent. No transportation is issued to the families of the employes. When it is desired to carry any men irregularly employed they are given employes' tickets made out in much the same manner as city transfers, except that these tickets have a blank space on which is written the name of the employe and date upon which the ticket is good.

C. N. Wilcoxson of the Cleveland & Southwestern stated that

the employes' transportation question is largely governed by the local conditions on each road. The simplicity of a system of employes' transportation should be a larger factor towards its adoption. If the headquarters of an interurban line are located in a small town it will be necessary to issue a comparatively large number of employes' tickets. On the Cleveland & Southwestern the higher officers are given books of 100 tickets limited to use by the owner whose name is written on the cover. These tickets are good for the calendar year in which they are issued. That there may be no mistake in the time limit of the tickets the year is printed in large red figures in the center of each ticket. All transportation is recorded and when a book has been used another will be issued on the return of the cover. Men employed in the shops and power house and trainmen are given strawboard tickets much like city transfers. These tickets are so printed that the dates may be cancelled with a conductor's punch and the name of the employe written in the blank space on the front of the ticket. The limits between which such tickets are good are punched by the issuing officer and those tickets given section men are good for one month. At the end of the month the section foreman turns into the office the cover and all unused portions of the tickets of his subordinates. Each foreman has a book of unpunched tickets and is provided with a punch so that he may issue transportation in case of emergency. The tickets for the section men are 60 in number, bound in a small book. The trainmen have an unlimited supply of tickets for their own use and ride as often as desired. Employes can have extra trip passes issued only for their wives. With this method the amount of free transportation is much larger than is usual on most roads, but with the headquarters located in the center of the road, necessitating much deadheading, it is not thought that the generosity of the management is being abused.

A. A. Anderson stated that the records of the Indianapolis & Cincinnati Traction Co. show that the free riding for the past three months has been eight per cent of the total number of passengers carried.

Mr. Jordan, who is now manager of the old Appleyard system, stated that the earlier and more elaborate transportation methods have been abolished and a simpler system put into practice. Single trip tickets are used for shop employes, section men and trainmen. Employes who ride regularly are furnished a book of 5-cent coupons. The wives of employes are given transportation whenever it is asked and it is the policy of the management to be liberal in issuing free transportation.

W. H. Forse, Jr., stated that five per cent of the passengers carried on the lines of the Indiana Union Traction Co. ride on free transportation, which percentage is not thought to be large. This company is discontinuing the use of card passes and now issues books of 200. 5-cent coupons.

President Spring stated that the management of the Dayton, Troy & Piqua encourages employes to ask for transportation. All this transportation is issued by the general superintendent and it is his belief that the privilege is not being abused.

A. A. Anderson introduced the discussion on the question "What is the best method of computing car mileage and car hours?" He stated that on the Indianapolis & Cincinnati Traction Co's. lines the mileage records for the cars are kept in the dispatcher's department. The car hour records are made up from the train sheets and the time train crews are on the line. Several copies of the completed mileage statements are made and these are distributed to the heads of the various departments.

Mr. Mitten stated that individual records were kept on the Indiana Union Traction Co., each card in a set of records representing the performance of one car.

Mr. Wilcoxson of the Cleveland & Southwestern said that the dispatcher on his line makes up a car mileage report from his train sheet. Each end of this sheet is so ruled that the information for the report may be easily tabulated. When the report is completed copies are made and distributed to the master mechanic, general manager, dispatcher and superintendent. These records are filed according to the loose leaf system with two pages for each car.

Harrie Clegg thought that if the mileages of the various parts of a car were calculated from the number of miles run by a car, inaccurate results would be obtained since it is often necessary to transfer parts from one car to another. He believed that individual records should be kept for each part of the equipment.

Mr. Wilcoxson thought this objection could be met by keeping a card record made up from the general record, each card bearing the performance of a particular part of the car. He stated that such a method is in use on the road with which he is connected and all wheels, axles and similar parts are referred to by number.

M. H. Evans of the Indianapolis Traction Terminal Co. thought that the car mileage methods as stated were too complicated for use on a city system operating a large number of cars over comparatively short routes. He described what he thought to be a more suitable method for city work. In this case the total mileage would be calculated each day from the schedules as laid out for the day's runs and any long or short runs would be added or deducted. This method would consider only revenue mileage. When the total mileage was thus obtained it would be subdivided according to the lengths of the runs on each route.

Mr. Jordan of the Appleyard system stated that in his earlier experience he had been mileage clerk on a city system which owned 100 cars and regularly operated 60 of these cars on the various divisions At this time it was his duty to keep an accurate record of the mileage of the various cars which task occupied about an hour and three-quarters of each day.

While at Dayton a number of managers representing properties in the central states held an informal meeting and discussed the proper charges for carrying baggage. While there was no definite action taken, it seemed to be the general sentiment that all roads should handle baggage free.

During the noon hour the supply men in attendance at the convention held a meeting and appointed a comittee which will solicit small contributions from the various manufacturing concerns which usually send representatives to the convention meetings. These contributions will be used to help make up the deficit which is found to exist in the finances of the association. The manufacturers' repersentatives committee is composed of John Ohmer of the Ohmer Fare Register Co., W. N. Bloss of the Buda Foundry & Machine Co., and C. Drake of the Galena Signal Oil Co. In the near future this committee will send out a circular letter requesting the co-operation of the manufacturers in the territory of the Central Electric Railway Association.

The Traction Engine in the Electric Railway Field.

A traction engine is being used for hauling ballast and other material on the Lancaster & Eastern Ry., which is being built between Lancaster and Christiana, Pa. The engine is mounted on a tram car as is shown in the accompanying illustration, the wheels

UNIQUE TRACTION-ENGINE LOCOMOTIVE.

of the engine first having been removed. The main gearing of the engine is connected by a sprocket wheel, to the axles of the improvised trucks. This unique locomotive is geared to run 10 miles an hour and is proving of considerable service in the construction work.

It has been announced that the wages of all motormen and conductors of the Milwaukee Electric Railway & Light Co. have been increased one cent an hour. The new scale went into effect on May 1st last.

The Power Transmission Line and Third-Rail System of the Long Island R. R.

The lines of the Long Island R. R. first to be electrically equipped comprise the Atlantic Ave. Division, between Flatbush terminal and Belmont Park, the Rockaway Beach Division between Woodhaven Junction and Rockaway Park, the Far Rockaway Division to Valley Stream, the Old Southern Road from Jamaica to Springfield Junction and the Montauk Division from Springfield Junction to Valley Stream. Current for the operation of the cars on these divisions is generated in the Long Island City power house and transmitted to sub-stations where it is converted and fed to the working conductors.

After a thorough study of traffic conditions Woodhaven Junction, East New York, Grand Ave., Rockaway Junction and Hammel were selected as permanent sub-station locations. Since the original installation described in this article was completed, a sixth sub-station has been located at Valley Stream, receiving its power from an extension of the overhead line by way of Springfield Junction. Two portable sub-stations were also provided as the most economical method of supplying current for the very heavy periodic traffic to and from the Metropolitan race track south of Jamaica, and the new Belmont Park race track about five miles east of Jamaica. These loads occur for two hours each day for periods of two weeks, twice a year. Each portable sub-station consists of a 1,000-kw. rotary converter, together with its transformers and switchboard, mounted in a heavy steel box car. A house, built of structural steel and enclosed with expanded metal and concrete, is provided at each portable sub-station site to enclose the terminals and shelter the portable apparatus when in use.

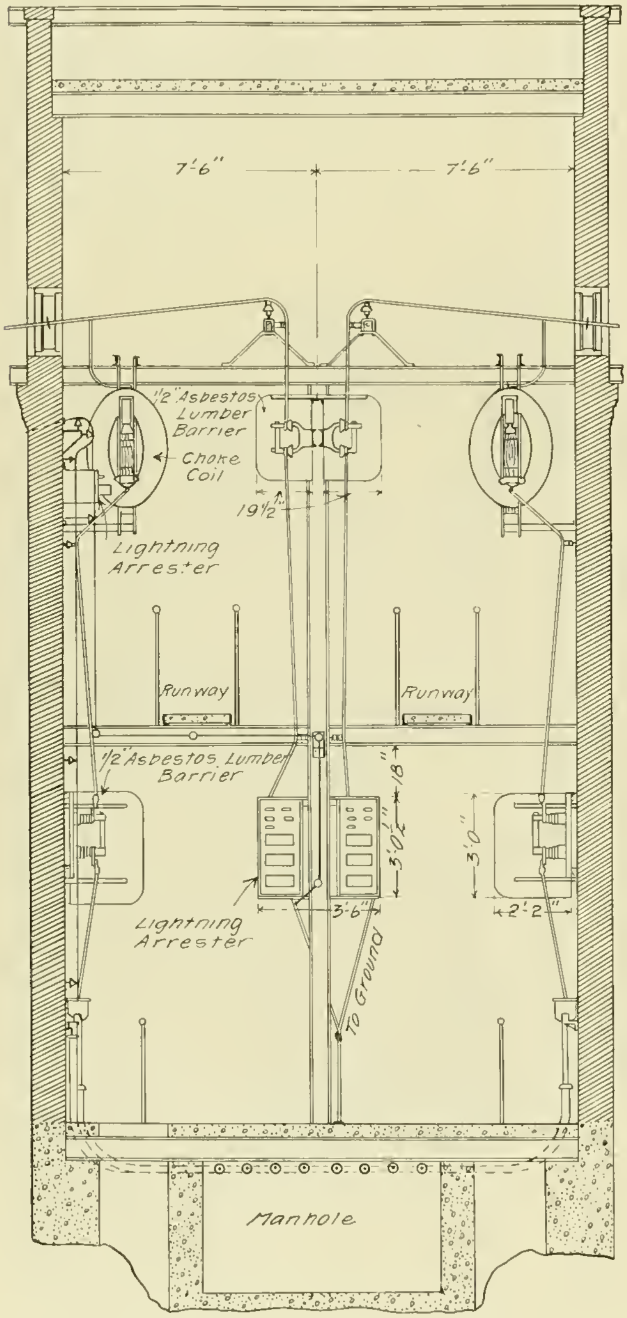
As a means of reaching a decision as to whether the overhead or underground type of construction should predominate in the transmission system, a very careful study was made of the record of experience in operating lines of great length and of large carrying capacity. Comparing the causes and effects of the troubles in the two classes of construction, the general conclusion was reached that, while an overhead line is liable to more frequent interruption through minor troubles than an underground line, the interferences with continuous operation on an underground line, when they do happen, are likely to be of a more serious character, and of longer duration. Experience showed conclusively, that the principal causes of interruption to service in overhead circuits could be prevented by proper attention to mechanical sufficiency in the overhead structures; a characteristic which, though necessary, has frequently been overlooked in the past. Although underground construction might have been preferred, could its cost be brought down to something like an equality with overhead costs, financial considerations favor the adoption of the overhead type because its cost is only a fraction of that for high tension conduit work, and because its reliability is assured when properly installed. Overhead construction was therefore adopted wherever conditions of roadway would permit.

The impracticability of constructing high tension overhead lines

MAP SHOWING LINES OF THE LONG ISLAND R. R.

in thickly populated sections of Brooklyn and Queens required recourse to underground construction in two sections of the line, one of them comprising 1⅛ miles of the main trunk line. Except where submarine cables were used, at the Broad Channel and Beach Channel drawbridges in the Jamaica Bay trestle, the remainder of the transmission line is of the overhead type of construction.

The trunk line as originally built carries five circuits from the power station to Woodhaven Junction sub-station, running in an 18-duct conduit line to Dutchkills St., thence on a line of steel poles



VERTICAL SECTION THROUGH LIGHTNING ARRESTER HOUSE ON THE MAIN TRUNK LINE.

which follows the right of way of the Main Line Division, to a point about due north of Glendale Junction, where it bends to the south across the fields for about a mile, until it strikes the Rockaway Beach Division, which it follows to Woodhaven Junction. A branch line of three circuits runs westward from Woodhaven Junction to the East New York sub-station, two circuits running thence to Grand Ave. sub-station, all these being run in underground conduits. To the east of Woodhaven Junction there are two circuits run underground to Dunton where the transmission is changed from underground to overhead, continuing easterly on steel poles to Rockaway Junction sub-station. The branch circuits from Rockaway Junction to the portable sub-station terminal buildings at Belmont Park and Springfield Junction, are carried on wooden poles running along the Main Line and the Montauk divisions respectively to their destinations. Southward from Woodhaven two circuits follow the Rockaway Beach Division across the Jamaica Bay trestle to Hammel sub-station. These circuits are carried on a line of steel poles to the southern outskirts of Ozone Park, half a mile or more from the sub-station, and the remainder of the distance on wooden poles.

At Woodhaven Junction the incoming trunk line circuits are distributed along a set of bus-bars called the "transfer bus" and divided into sections from which the outgoing transmission circuits lead in various directions. It is possible by manipulation of the bus-junction switches to operate these circuits separately or together, from outlying sub-stations all the way back to the power station. The same general arrangement is carried out in a smaller degree by similar transfer busses at East New York and Rockaway Junction.

The length of the various sections of the transmission lines are as follows:

Conduit section of trunk line, power station to Dutchkills St., 1.12 miles. Overhead trunk line Dutchkills St. to Woodhaven Junction, 7.85 miles. Conduit section from Woodhaven to East New York, 3.23 miles, and from East New York to Grand Ave., 3.04 miles. Woodhaven to Dunton, 1.7 miles. Overhead from Dunton to Rockaway Junction, 1.73 miles, Rockaway Junction to Belmont Park, 3.71 miles, Rockaway Junction to Springfield Junction, 3.35 miles, Springfield Junction to Valley Stream, 2.57 miles, Woodhaven Junction to Hammel, 6.98 miles. The total mileage of conduit lines now in use is therefore 9.09 and that of pole lines, 26.19 miles.

Conduit Construction.

Between the power station and the railroad tracks, the construction of the conduits involved no serious complications. The remainder of the underground line involved not only some blasting through a ledge of rock, but its construction was rendered especially difficult because much of it was situated below the level of the ground water, so that special provision for the drainage of the ducts and manholes was necessary. An eight-inch pipe under the line of conduit, leads the drainage to three sumps. These sumps are kept pumped out by electrically driven submerged centrifugal pumps, automatically controlled and discharging into the city sewer system.

This conduit line is constructed of single vitrified clay ducts 18 in. long, with square holes 3 13/16 in. inside measurement and walls ¾ in. thick. The ducts are 7/16 in. greater in diameter than usual in order to facilitate the installation of the three-conductor high tension cables, which are nearly three inches in diameter. A single duct was preferred to multiple ducts because of the thicker wall between ducts which is better able to resist heat in case of a possible short circuit. A square hole with rounded corners was preferred as affording space for dirt and pebbles to slide to one side instead of being dragged along underneath the cable and injuring the sheath as would be the case if round ducts had been used. The ducts are laid in cement mortar in such a way as to break joints in all cases and are surrounded on the top, bottom and sides by a covering of concrete four inches thick composed of 1 part portland cement, 2½ parts sand and 5 parts broken stone. The ducts are arranged three wide and six high.

Manholes are located 400 ft. apart on straight work and a shorter distance on curves. The standard manhole for straight line work is 8 ft. long, 4 ft. wide and 6½ ft. high, inside dimensions. The manholes are built of concrete of the same composition as that surrounding the ducts

The conduit system on Atlantic Ave. comprises two kinds of construction. The portion lying between Atkins Ave. and Dunton, a distance of 4.4 miles, is in general identical with the construction as just described for the main transmission line. The Atlantic Ave. Improvement conduits are built of four-way vitrified clay ducts 36 in. long with square holes 3⅜ in. on a side. These ducts are laid in cement mortar, the joints being first covered by a wrapping of cotton cloth saturated with portland cement grout. Where the ducts are laid beneath the surface of the street, the assembled ducts are surrounded by a wall of concrete three inches thick on the sides and four inches thick on the top and bottom.

On the subway portion of the improvement, the manholes for the conduit lines consist of niches in the side walls. On the other portions of the Atlantic Ave. Improvement the manholes are built of concrete and are generally oval in form.

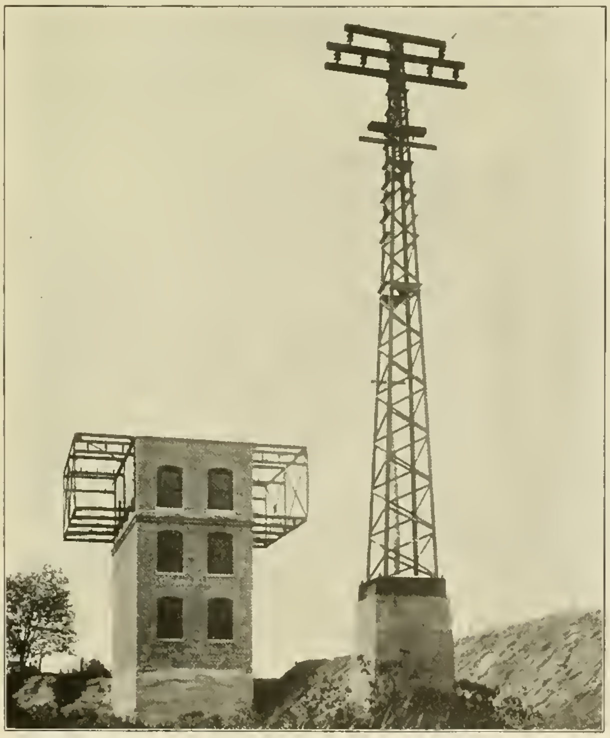
Underground Cables.

The underground high tension cables are of the paper-insulated three-conductor type, each conductor having a cross section of 250,000 c. m., and being composed of 37 copper wires. The completed cable has an outside diameter of 2⅞ in. Each length of the cable was tested at the factory and was again tested when in place by applying 30,000 volts pressure between each pair of conductors, and 27,000 volts pressure between each conductor and the sheath for a period of 30 minutes.

At each end of every high tension cable there is sweated on to the lead sheath a spun brass end-bell, which is filled with "No. 67" G. E. compound, to properly seal the ends of the cable and prevent injurious static discharges. The three conductors are brought out separately through a wooden head in the end-bell. Each is wrapped with varnished cambric tape, and surrounded by a micanite tube to give additional insulation.

At the drawbridges in the Jamaica Bay trestle, the cables are of the armored submarine type and the conductors are rubber insulated. There are two such cables at each drawbridge.

The high tension cables are located in the lower portion of the conduit system with the idea of separating them from any other cables which may subsequently be installed. They are carried around the sides of the manholes in racks. The minimum radius of bend in this type of cable is 18 in. Where exposed in the manholes and at the sub-station terminals, the cables are wrapped with a layer of hard rolled asbestos mill board ⅛ in. thick. Outside of the asbestos mill board there is a wrapping of asbestos listing two in. wide, laid on until it averages ⅜ in. thick. The whole is then wrapped with galvanized iron tape 1/64 in. thick and ½ in. wide, laid on with edges overlapping. At each manhole, there is a strip

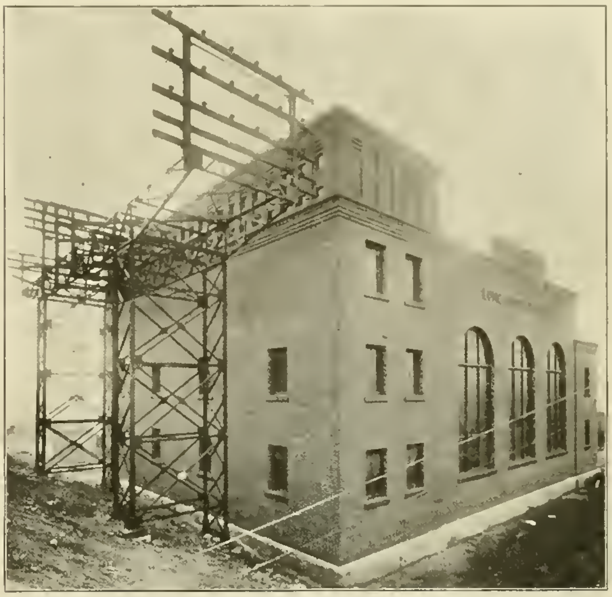


STRAIN POLE AND ARRESTER HOUSE AT DUNTON.

of sheet copper sweated on to the lead sheath and brought out through the wrappings to allow of grounding the cable should it be necessary to protect it from electrolysis. Before the cables were pulled into the ducts, a wooden mandrel 3 ft. long and 3⅛ in. in diameter was pulled through to insure a clear passage.

At the Jamaica Bay drawbridges, the armored cables were laid across the channel and allowed to settle to the bottom. A diver then arranged them so that they were properly separated, and they were sunk four feet into the mud by means of a water jet, supplied by pumps at 100 lb. pressure.

The high tension cables were all manufactured by the General Electric Co. and all except the submarine cables were drawn in, jointed and installed complete and ready for operation by this company.



TERMINAL CABLE RACK AT THE SUB-STATION AT WOODHAVEN JUNCTION

There is a total of about 25 miles of high tension underground cable installed, and .418 miles of armored submarine cable.

Arrester Houses.

Wherever the underground cable section of the transmission line is joined up with the overhead system, lightning arresters and choke coils are installed. Suitable houses are provided to shelter this apparatus. There is one house on the main transmission line at Dutchkills St., Long Island City, and another at Dunton, on the branch line running east of Woodhaven. Smaller houses were also provided for the same purpose at the two drawbridges.

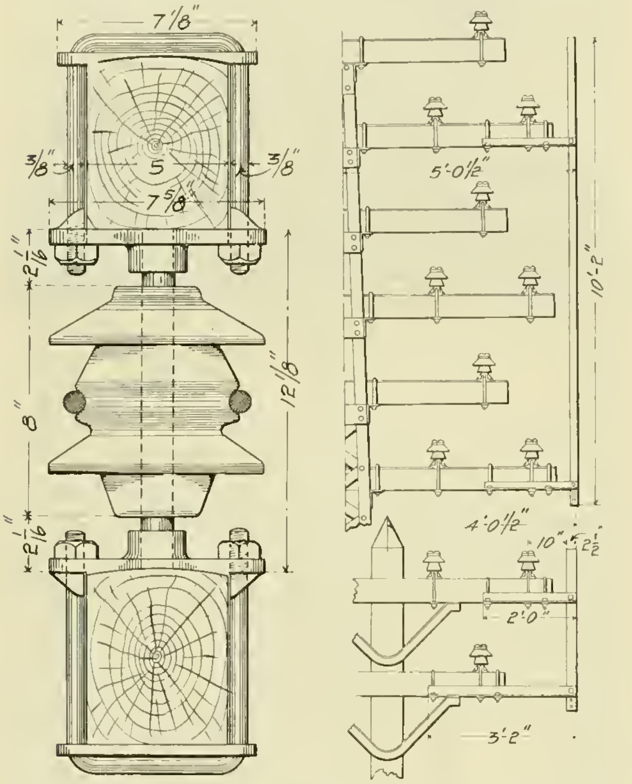
The house at Dutchkills St. is a brick structure with sufficient room for eight outgoing overhead circuits which leave the house four on a side. The general design of the transmission line is such that the circuits on one side of the poles can be shut down for repairs without shutting down those on the other side, and this idea was carried out in the construction of the arrester house, so that there would be no confusion possible between live and dead conductors wherever it might become necessary to do any repair work on the line. The arrester house, a vertical section of which is shown, is 33½ ft. long, 17½ ft. wide and 30½ ft. high inside, and is constructed of brick with a concrete floor and roof. The steel beams supporting the apparatus extend to the outside of the building, forming a series of racks for the support of the transmission cables which are dead-ended upon them. The arresters are provided with knife switches, so that they can readily be disconnected from the circuit. A choke coil is also provided in series with each main circuit, and another knife switch between the choke coil and the cable bell, enabling the cable to be entirely disconnected from the overhead line. Wood has been entirely omitted in the construction of this arrester house. The incoming cable ducts are arranged along the walls. The main circuit passes through switches and through the choke coils to the various outlets through the outside walls. The arresters are mounted on either side of the steel framework shown in the center of the building. The ground connections from all arresters run to a single ground lead consisting of 5½ sq. ft. of copper plate buried in the ground between layers of crushed coke. The arresters are of the Westinghouse low-equivalent type mounted on marble slabs, which in turn are carried upon porcelain insulators.

After leaving the racks upon the sides of the building, the outgoing cables on each side are anchored on a strain pole. The openings in the side of the house through which the cables run, are 18

in. square, enclosed by two glass plates ⅜ in. thick. These plates have 2½-in. holes in the centers, through which the wire passes without touching the glass. A thin disk of brass 2½ in. in diameter is attached to each wire midway between the glass plates, and thus prevents the direct access of rain or snow through the openings. Standard straight line insulators are used for supporting the bare wires inside of the building.

A similarly built and equipped house is located at Dunton where the branch transmission line running eastward from Woodhaven is changed from conduit to overhead construction.

At the drawbridge channels in Jamaica Bay, three houses are provided to shelter similar apparatus. These each consist of a steel framework covered with expanded metal and concrete side walls and a corrugated copper roof. These houses rest upon pile foundations. The method of entrance of wires is similar to that used in the house at Dutchkills St. and the strains of the overhead line are taken by a separate anchorage composed of four poles braced together forming a stiff wooden tower which carries the longitudinal strains of the line without guying.



STRAIN INSULATOR FASTENING AND DETAILS OF CABLE RETAINER FOR CURVE CONSTRUCTION.

Overhead Line Construction.

There are two general divisions of the overhead construction, the trunk line between Dutchkills St. and Woodhaven Junction, and the branch lines between the latter point and the other outlying sub-stations. The trunk line is built with steel poles. The branch line between Dunton and Rockaway Junction, through which the sub-station at the latter point and two portable sub-stations are fed, and upon which pole line the circuits to stations not yet constructed may eventually run, is therefore also built with steel poles. From Rockaway Junction, the branch pole line to the separate outlying sub-stations are built with wooden poles. Because of the rather exceptional height at which the cables have to be carried to clear other wires the poles are of steel from Woodhaven Junction to the southern outskirts of Ozone Park. From Ozone Park to Hammel wooden poles are used.

The pole lines have not been duplicated because it was thought that a sufficient degree of security would be obtained by constructing a single pole line in the most substantial manner.

The trunk line is designed to carry eight three-phase transmission circuits, each consisting of three 250,000-c. m. cables, together with eight low tension cables of 500,000 c. m. cross section each. As the latter when installed must be 25 ft. above the ground, and as there must be an ample clearance space between the low and the high tension circuits, the necessity for using steel tower construction to carry such an unusual weight of overhead conductors is apparent.

As the branch lines are not intended to carry more than two three-phase transmission circuits and four low tension cables a single line of heavy wooden poles is used.

Steel Poles.

The steel poles are of various sizes to meet differing conditions. Each is designed to carry 24, 250,000-c.m. cables, on its upper portion, and underneath these an additional load of 8, 500,000-c. m. low tension cables which local regulations require to be at least 25 ft. above the ground. The distance between steel poles averages 150 ft., except at corners or railroad crossings.

The steel poles are of a lattice type of construction. They are tapered uniformly to the top on two sides and to within about 7½ ft. of the top on the other two sides. The taper is ⅜ in. per foot. This taper is uniform to the bottom of the pole and is the same for all lengths of poles. The tops are all 6×11 in. in size. At the bottom the corner angles are tied to a base composed of plates and channels through the corners of which pass four anchor bolts. This forms a sort of box construction around the base of the pole and greatly increases its stiffness and stability. The use of bolts enables a foundation to be built and the anchor bolts set at any convenient time independent of the delivery of the poles, thus affording very desirable flexibility in the organization of the pole-setting force.

The standard poles are made in four lengths, increasing by 5 ft., from 39 ft. to 54 ft. in length, the 39-ft. pole being the standard. The other lengths are only used where necessary. On account of the earlier mentioned uniform taper, the sizes of the bases vary from 3½×4 ft. to 4½×5 ft. The foundations are therefore proportioned accordingly. From a detailed survey of the line the length and the location of every pole was determined upon before construction began, and every foundation built to fit the size of pole assigned to that particular location.

The poles are designed to withstand a wind pressure due to a wind velocity of 100 miles per hour acting at right angles to the line. This was calculated from data obtained in the Berlin-Zossen high-speed railway tests which showed the pressure on a flat surface due to a wind velocity of 100 miles per hour to be about 27 lb. per sq. ft. For the projected area of cylindrical conductors, one-half of this value was used for the wind pressure.

For standard straight line poles, without side strains other than wind pressure, the corner angles are 3 x 3 x ⅜ in. For the heavier strains at curves and corners, the general design of the poles is the same but they are given greater strength by using heavier corner angles, and in some cases a greater taper. At all sharp turns, three poles of the heavy-strain type are used. Two of these take the longitudinal strains and are guyed back to the base of the middle pole, which takes the side strains due to the offset. The strain poles used for anchorage are guyed to the bases of the adjacent poles with 7/16-in. galvanized steel cable. On some sharp curves the poles were guyed laterally as an additional precaution, using 7/16-in. cable and Stombaugh guy anchors.

The construction of the steel pole includes angle-iron seats for the cross arms which pass through the pole structure, the weight of the cables holding the cross arms down on the seats and requiring only the simplest type of fastening which consists of two ¾-in. "U" bolts which clamp the cross arms immovably to their seats.

As a protection against lightning each steel pole is thoroughly grounded to a copper plate beneath the foundation.

Wooden Poles.

The wooden poles are of two kinds: chestnut, which is the standard for ordinary work, and creosoted yellow pine, which is used only along the trestles over Jamaica Bay. The chestnut poles are 45, 50 and 55 ft. long and 25 in. in circumferance at the top. The creosoted poles are from 60 to 80 ft. long, with the same dimensions at the top, and treated with 15 lb. of dead oil of coal tar per cubic foot of timber. The creosoted poles were set 15 ft. in the mud at the bottom of the bay by means of a water jet. These poles were braced to the trestle with creosoted yellow pine timber.

Cross Arms, Pins and Insulators.

The cross arms are of yellow pine, 5 x 6 in. in cross section, roofed on top to a 12-in radius. The arms are painted with one coat of asphaltum paint. On the wooden poles the cross arms are gained one inch into the pole and held by one 3/4-in. through bolt with 2-in. square washers. Bracing, which is unnecessary on the steel poles, was effected in the case of wooden poles by angle-iron braces made in one piece. For standard steel poles the arms are 7 and 9 ft. long. For steel strain poles, they are 7 ft. 10 in. and 10 ft. 6 in. long.

On the steel pole line the apex of the triangle, at the points of which the wires are carried is placed at the top, while on the wooden pole portions of the line the apex is at the bottom. The latter position is that generally preferred for the arrangement of high tension circuits as it allows repair men more room to get up between the circuits.

The insulator fastenings consist of malleable iron pins clamped to the cross arms by means of U-bolts threaded through the body of the pin, and held by a plate fitting over the U-bolts and against the cross arm. This type was first used on this transmission line and represents a new departure in pin design, inasmuch as by its use all boring of the cross arm is avoided.

The straight line insulators are 6½ in. in diameter and 5 in. high, made of porcelain in two parts cemented together. The insulators which are colored with a brown glaze, were designed particularly for the conditions here imposed. The pin and insulator together carry a 250,000-c.m. cable 6½ in. above the cross arm. The ties are made of ordinary soft copper wire, tied on top.

The strain insulators are of the "spool" type and made in one piece 7½ in. in diameter and 8 in. high. Each strain insulator has two petticoats, one above and one below the point where the wire

SWITCH AND CIRCUIT BREAKER HOUSE FOR THIRD-RAIL CIRCUITS.

is attached. A 1⅛-in. by 12-in. steel pin is cemented in the center of the insulator, and this steel pin rests in sockets at the top and bottom which are firmly clamped by U-bolts to the cross arms.

The insulators were cemented to the pins before erection. The cement used throughout was composed of litharge moistened with a mixture of glycerine and water. After careful trials this type of cement was found to be preferable to portland cement.

Cables.

The transmission cables are of 250,000-c.m. section stranded copper and are fastened to the insulators with ties of No. 6 copper wire, 3 ft. long. The cables were strung for the most part by means of teams of horses and running lines of 1,000 ft. or more in length, the cable reels being mounted on stationary stands. On the trestle, however, the reel of wire was carried on a flat car upon which was a boom, capable of being swung to one side. To the end of this boom was attached a snatch block, through which the wire passed and by which it was guided on the cross arm as the car moved. The total amount of transmission cable is 62.03 circuit miles, or 186.09 miles of cable.

There are no low tension cables on the poles at present, but when installed they will be carried upon heavy porcelain top groove in-

STRAIN TOWER AND ARRESTER HOUSE AT BROAD CHANNEL DRAWBRIDGE.

sulators and pins of the same general type as previously described.

Where the power transmission circuits cross the highways or railroad tracks, special precautions were taken to strengthen the line construction against the possibility of a cable falling off a cross arm and hanging down in a position which would endanger passing traffic. Where the wires cross other electric circuits the high tension wires are carried above the others as their large size and strong mechanical supports make them less liable to fall upon others than would be the case if the position were reversed. At all crossings, over station platforms, and on the inside of curves, vertical angle irons called "retainers" are bolted to the ends of the cross arms so that if an insulator breaks or a cross arm burns off, the wire cannot fall any considerable distance away from its normal position.

After the pole line was finished, the railroad company installed a telephone line, which is carried on the same poles that support the power circuits and furnishes a means of communication between the power house and the sub-stations. The instruments for this line are mounted in boxes at intervals of about 2,000 ft. and are used by the men patrolling the line.

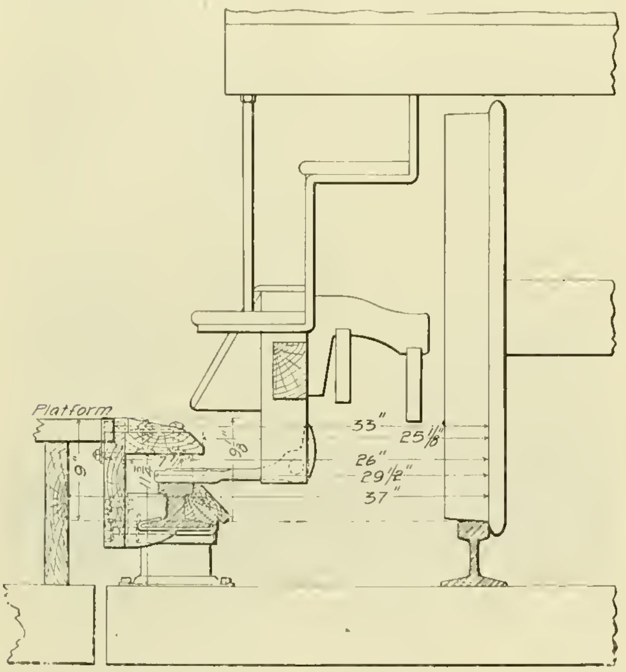
Terminal Cable Racks.

At the Woodhaven and Rockaway Junction sub-stations, special teminal poles or racks are provided to distribute the overhead circuits along the face of the building parallel to the high tension switching galleries in such a manner that the disposition of the cables after entering the building will be most convenient. The conditions met at such places were somewhat conflicting. The disposition of the circuits on the line poles is such as to enable those on one side of the pole to be shut down for repairs while those on the other side are kept in operation, and it was desirable in leading the cables into the sub-station buildings to adhere as closely as possible to a disposition that would be consistent with this scheme.

The sub-station galleries were laid out for the most convenient subdivision of the high tension bus into sections for distributing power to the branch feeder circuits so that it was necessary to lead certain circuits into particular openings in the side of the building without special regard as to whether that particular disposition was the most convenient for keeping the circuits clear and free from crosses, outside of the building. An idea of the manner in which these conditions were met is best given by the reference to the

accompanying view of the sub-station at Woodhaven Junction.

The terminal racks consist, as shown in the illustration, of steel truss bridges about 11 ft. wide and practically as long as the side of the sub-station building, supported on latticed steel columns which are carried on concrete foundations. The wires are supported on standard insulators which are carried on the regular type of cross arms sawed long enough to project over both sides of the truss, to which they are fastened by U-bolts, as they are on the standard poles. Where the cables are dead-ended they are fastened to standard strain insulators. The adjacent poles on the trunk line are of the strain type so as to relieve the terminal poles of longitudinal strains. Plank runways are provided in the trusses to facilitate access for repairs.



SECTIONAL VIEW SHOWING PROTECTION FOR THIRD RAIL AT STATIONS.

At the larger lightning arrester houses, the terminal cable racks are integral with the building framework and project from the sides of the building.

In the illustration of the lightning arrester houses at the Broad Channel drawbridge on the Jamaica Bay trestle, is shown the method of anchoring the longitudinal strain of the high tension line. This anchorage consists of a tower-like structure of four creosoted poles latticed and braced together with heavy timbers. The cables are dead-ended on standard strain insulators in a horizontal plane. Jumpers are dropped through the inside of the tower and across the lightning arrester houses, through which the overhead cables connect with the submarine cables.

Type of Third-Rail Construction.

In the selection of the general type of third-rail construction adopted for the Long Island R. R. the general requirements were that both the rail and the contact device should be suitable for collecting heavy currents at any speed; the rail should be so placed as to encroach as little as possible beyond the fixed clearances of the permanent way; the design of mounting should be mechanically stable and besides including good insulation should provide a reasonable degree of protection to employes against accidental contact and be proof against interruption of service by weather conditions. It was also desired to settle upon a standard form and location of rail that would permit a free interchange of ordinary passenger and freight equipment between the Long Island R. R. and other railroads in the vicinity.

The third rail is placed with its gage line 26 in. from the outside of the gage line of the running rail and its top at a height of 3½ in. above the top of the running rail. The top contact type of construction is used and a horizontal type of guard extends directly over the rail, requiring the use of the slipper type of contact shoe.

The rail used for a considerable portion of the construction is a modified tee shape weighing 100 lb. to the yard, in 33-ft. lengths. The section is 4 in. high, with a head 3 in. wide, a bottom flange 6 in. wide, and a web 1½ in. thick. This particular shape was selected because of the limited vertical distance between contact and running rail tops requiring that the contact rail be of as low section as possible to provide a maximum insulation distance to the tie.

The rail is of extra soft steel with a resistance by measurement of a 100-lb. section, equivalent to 1,650,000 c. m. cross section of copper. All of the main line tracks on the elevated line are provided with this 100-lb. third rail with the exception of about 7½ miles, which are fitted with 70-lb. standard relaying tee rails. For side tracks and unimportant spur work, 60-lb. relaying rails were used. The third-rail splice bars are of rolled steel 18 in. long with four holes carrying bolts ¾x3¾ in. in size.

The contact rail is supported every 10 ft. on vitrified clay insulators set on extra long ties. The insulator used consists of a cylindrical piece of vitrified clay with a beveled flange projecting at the base and a two-inch hole through the center to aid in manufacture. A malleable iron ring with two projecting lugs and holes in each lug for lag screws, fits over the flange at the base of the insulator. Two lag screws are used to fasten the insulator to the tie. Resting on top of the insulator is a malleable iron cap which projects down over it for a distance of 1⅛ in. and has two ears 1¼ in. long projecting upwards. The rail rests on top of the cap between the ears. With this type of insulator, no vertical strain comes upon it due to the sagging of the tie when a train passes, as the rail is in no way directly attached to it.

The end approach blocks and inclines for lifting the third-rail shoes, are of cast iron. Two lengths are used, one being 5 ft. 6 in. long and used on main line tracks where the shoes must be raised and lowered at high speed; while the other, which is 2 ft. 6 in. long is used only on spur tracks and sidings. The approach blocks are attached to the end of the rails by the regular splice plates and are supported on standard third-rail insulators at their outer ends. The general design and arrangement of the approach blocks in position is shown in an accompanying illustration. The side approach blocks used at switches are of wood.

The third-rail joints are bonded by laminated copper foot bonds with plug terminals hydraulically expanded in the rails. They are of varying sizes according to the weight of the rail to which they are applied, 300,000, 350,000 and 400,000-c. m. sizes being employed. The holes for the plug terminals were punched in the base of the rail by hydraulic punches and the terminals riveted into the holes by hydraulic compressors. The terminals of the two larger sizes are ⅞ in. in diameter and for the 300,000-c.m. bonds they are 13/16 in. in diameter. The terminals of the 300,000-c.m. and the 350,000-c.m. bonds are five inches apart when installed. The 400,000-c.m. bonds are 10 in. long between the centers of the terminals when installed. All the work of punching and bonding was done after the rails were in place.

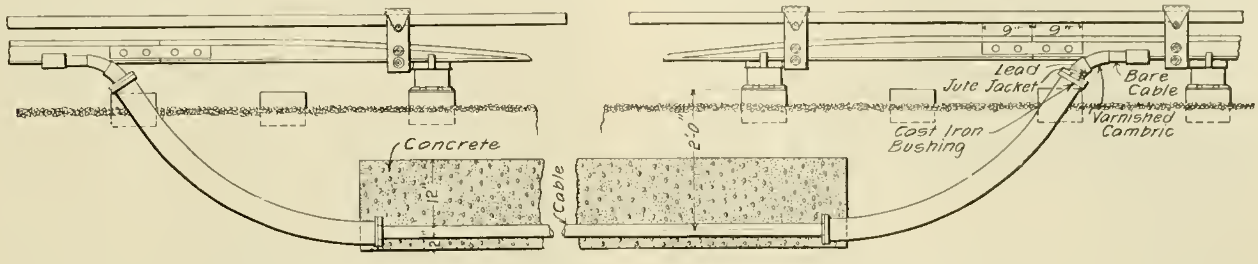
Cable Jumper Construction.

The third rail is frequently interrupted by highway crossings and switches, and at such places underground cables are provided to maintain the electrical continuity.

These cables are in three sizes, 500,000 c. m., 1,000,000 c. m. and 2,000,000 c. m. cross sectional area. The cable is insulated with varnished cambric and covered with a lead sheath. Outside of the lead there is a layer of prepared paper and two layers of jute wound on spirally in opposite directions and thoroughly impregnated with asphalt. This unusual precaution is taken to protect the lead from acids and alkalies in the soil and from the possible electrolytic action of return currents in the ground. The cable was subjected to a 3,500-volt factory test. It is buried not less than two feet below the surface of the ground, and except under public highway crossings a two-inch plank laid on top of it constitutes its only protection. At highway crossings, however, a mass of concrete about a foot thick is substituted for the plank in order to insure protection against injury in case the streets are opened. The accompanying drawing shows the standard arrangement of jumper cables at public crossings. The ends of the cables come to the surface through curved 3½-in. iron pipes fitted with regular conduit bushings, and extending about six inches above the surface of the ground. The ends of the conductors are connected to the third rail by special brass terminal lugs sweated upon the conductors. Each lug has

sockets for four 400,000-c. m. flexible cables. Short cable bonds, each with a copper plug terminal drop forged on one end, are soldered into the socket, and after pigtailing these terminals to provide flexibility the plug terminals are compressed into holes in the base of the rail.

Since these cable terminals are very close to the ground level and are always exposed to the weather, they are insulated with special care. The lead and jute coverings are cut back for a distance of seven inches from the point where the cable enters the lug, and the insulation is cut back to leave three inches of bare cable exposed. This space, as well as the four inches of exposed insulation is then wound with varnished cambric tape applied with Stirling varnish between the layers. It is then painted with P & B paint and wound all over with adhesive tape, including the whole surface of the lug, thus leaving only the bond connections bare. The end then receives a final coat of P & B paint. The ends of the iron pipe are plugged with oakum around the cable to prevent dirt from entering and to prevent any movement of the cable in the pipe.



STANDARD ARRANGEMENT OF THIRD-RAIL CONNECTING CABLES AT PUBLIC CROSSINGS.

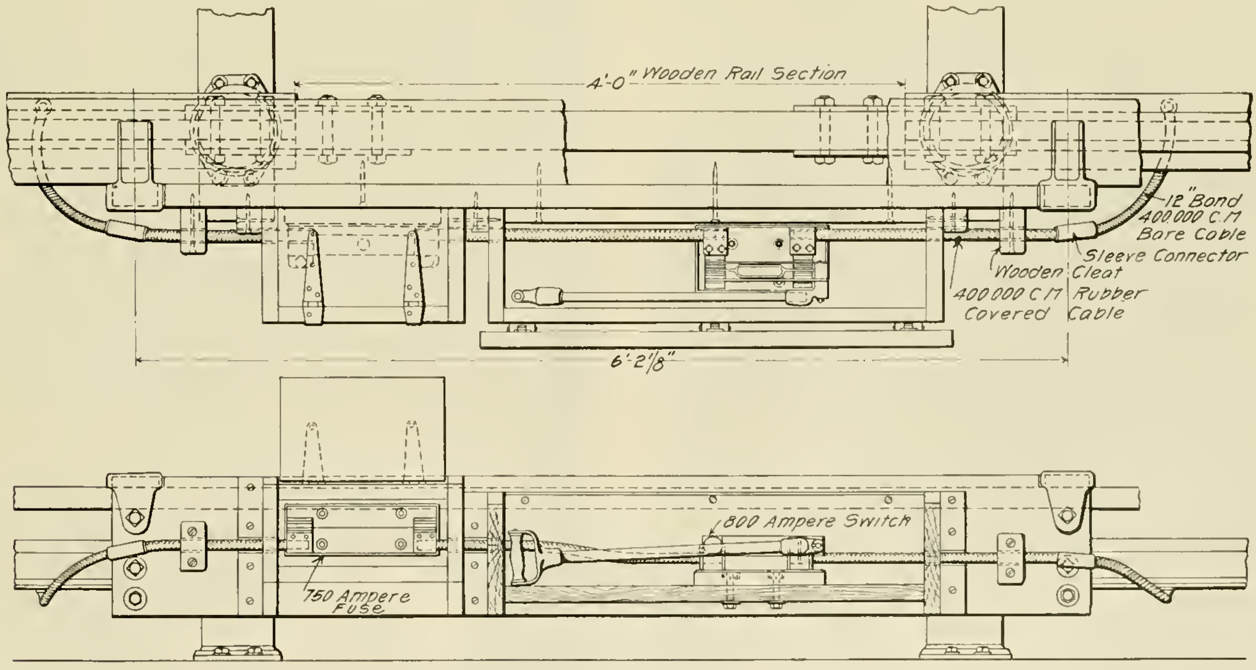
Third-Rail Guard.

The type of guard adopted for the third rail consists of yellow pine plank 1⅞ in. thick by 7 in. wide, placed above the rail with 2½ in. of clear space between the top of the rail and the under side of the plank. The edge of the plank nearest the track rails extends ⅞ in. beyond the line of the third-rail head and is beveled back to give the necessary clearance for the running equipment. Each plank has a saw cut ⅜ in. deep in the middle of the underside to prevent warping. The planks vary in length from 14 to 16 ft. The guard is supported directly from the third rail, there being four supports to each plank. The planks are butted together without splicing so as not to interfere with the free expansion and contraction of the rail and to facilitate repairs.

The supports for the guard consist of upright posts of oak and chestnut 1⅞ x 3⅞ x 11 in. in size carrying a malleable iron cap which fits down over the top of the post and is held to it by a carriage bolt. This cap has a projecting bracket against the under side of which the guard plank is fastened by two carriage bolts with heads countersunk on the underside of the plank. One of the bolt holes in the iron cap is slotted transversely so that the plank may not split by shrinkage. The wooden post is carried on a malleable iron casting which fits closely against the web and around the bottom flange of the third rail so that a single hook bolt engaging with and passing under the bottom flange of the rail clamps the guard post firmly to it.

Additional protection is provided for the third rail at stations as shown in one of the illustrations. This additional protection on the outer side of the rail consists of a yellow pine strip 4 x 1¼ in. in section set at an angle of about 45 degrees with the rail and almost completely covering the side of it. This strip is nailed to wooden blocks fastened to the web of the rail in a manner similar to that used on the side approach blocks. Where necessary this side guard is placed on both sides of the third rail.

All the timber guards are painted with two coats of a good quality of weather-proof paint. Experience up to the present time leads to the belief that the guard will prevent most of the troubles that commonly arise from sleet.



THIRD-RAIL DISCONNECTING SWITCH AND FUSE. LONG ISLAND R. R.

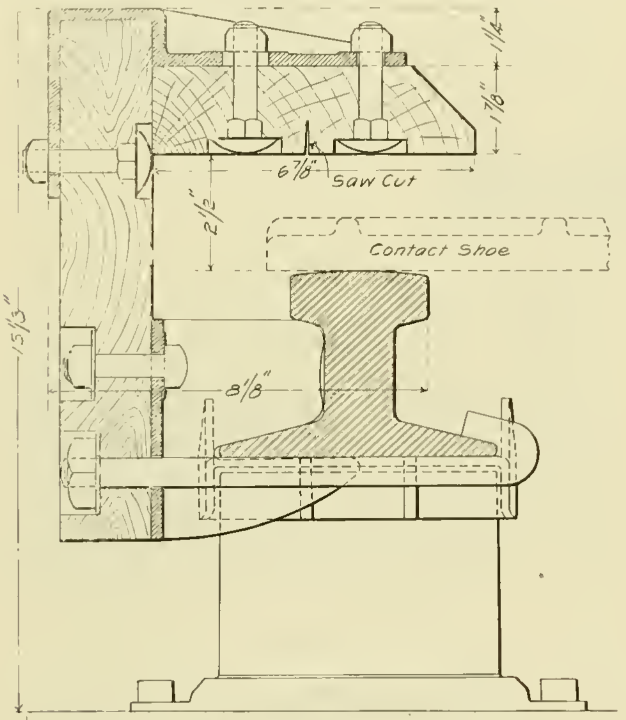
At the drawbridges in the Jamaica Bay trestle, the third rail is interrupted, and to maintain electrical continuity three submarine cables are installed, one for each third rail, and one as a spare. These cables were laid in the same manner as the high tension power transmission cables which have already been described. The short length of third rail on the drawbridge is connected by brass contact shoes, which make connections at each end of the draw when it is closed.

Third and Track-Rail Connections.

The cables connecting the third rail with the sub-stations are all of 2,000,000-c. m. section and connections are made directly in

front of the sub-stations. In some cases these short feeders are located in conduits and in other cases laid directly in the ground in the manner as described for the crossing jumpers. Such cables when laid in ducts are insulated with 5/32 in. of paper, covered with a layer of sheathing 1/8 in. thick.

Near each sub-station the third rail is interrupted by a 40-ft. gap. Should any section break down it is then impossible for a single car to bridge the gap between the live rail and the grounded one, thus avoiding the possibility of injury to the car wiring and equipment. The east and westbound tracks are in most cases supplied by a separate set of feeders and are not cross connected except



SECTIONAL VIEW OF THIRD RAIL AND GUARD.

through the station bus-bars. Current can therefore be cut off from the section of either track lying between two sub-stations simply by opening the proper feeder switches in the stations at each end of the section.

In order that part of a section between two sub-stations may be disconnected in case of emergency, instead of requiring the whole section to be thrown out of service, 1,600-ampere capacity, disconnecting switches are installed at suitable intervals between sub-stations. These switches are cut into the third-rail circuit so that by opening any two of them the section between them will be cut out. Normally these switches are kept closed. They are generally located near the cross-overs to enable trains to switch around the opened section on the other track. The switches are of the quick-break, knife-blade type and are located in wooden boxes fastened to the third-rail guard, as shown in one of the illustrations. In some instances fuses alone are installed.

The only places where the east and westbound rails are connected are at the entrance to the yards at the Rockaway Park terminal, at Jamaica Station and at the north end of Jamaica Bay trestle. At each of these points the two tracks are tied together by a 2,000-ampere switch, and circuit breaker, mounted under shelter and conveniently located by means of which they can be separated when necessary.

There are several very important points on the line where the arrangement of interlocking switches is such as to require special provision for cutting the third rail into sections.

Return Circuit.

About 20 miles of track on Atlantic Ave. is laid with 100-lb. T-rail. The remaining portion of the electrically equipped system is laid with various weights of rail running from 60 to 80 lb. per yd.

The problem of bonding the rail joints was solved by different methods on different portions of the line, depending largely upon the local conditions. The rails having been practically all laid when the work of equipment began, the type of joint plate then in position had much to do with the various types of bonds used.

It was found impossible to install bonds of sufficient size beneath the splice bars already in use. Foot bonds could not be used on the elevated portions of the Atlantic Ave. Improvement because this track had supported joints, and where the tracks were laid on the surface they could not be used because the leakage through them would unfavorably affect the operation of the signal system. On a portion of the line which has no automatic block signal system, however, soldered foot bonds placed underneath the rail joints were used.

A good deal of the bonding was done with laminated bonds of the soldered type, attached to the ends of each splice bar, requiring four bonds per joint. The bonds have a cross section of 486,000 c. m and are one-quarter of an inch thick, and two inches wide, composed of layers of copper ribbon. In the tunnel sections cable bonds 45 in. long spanning the splice bar and with terminals compressed into the rail webs were used. These are of 350,000-c. m. cross section and as the rail is of 100-lb. section three are installed at each joint. On the elevated portion of the line and on the Jamaica Bay trestle, the guard rails which weigh 56 lb. per yd. are bonded together and used as a part of the return circuit. The bonds used for these rails are also of the soldered type built up of copper ribbon and fastened to the side of the rail head. They have a cross section of 560,000 c. m. per joint.

The rail bonding was a difficult piece of work to execute. As much of the track was in constant use, the work had to be done during a severe winter and under the worst conditions, which were unfavorable to efficient installation of the soldered type of bond.

The spots where the bonds were applied on the rails and splice bars were cleaned by means of sand blasts operated by air compressors driven by steam or oil engines. After a little practice it was found that the soldered type of joint could, with the exercise of proper care, be made efficient and durable, but the vibration of the splice bars under heavy traffic subjected them to unusual service. On new work where it was possible to control the cross section of the splice bars to accommodate the protected type of bond between the running rail and splice bars, this type of bond was used.

Where the automatic block signal system is used, it is not possible to cross bond the running rails on account of the disturbance in the signal system which would thereby be occasioned. On other portions of the line two 350,000-c. m. capacity bonds of the plug-terminal type were installed between the rails of the same track and between adjoining tracks, at intervals of about 1,500 feet. A special arrangement was devised for cross bonding a portion of the line where the automatic block signal system is used. The cross connections only occur at the end of the signal blocks where the special inductive bonds are cut into each track rail. These inductive bonds serve to keep out signal current, but for the direct current, act exactly the same as the ordinary bond, and maintain the continuity of the running rail. The cross connections between the tracks are made at these points, the inductive bonds being used in both tracks so that the signal system is not affected by the flow of current between them

At the two drawbridges in the Jamaica Bay trestle, the continuity of the return circuit is maintained by four 2,000,000-c. m. capacity rubber-covered armored cables at each crossing similar to those used for the third-rail circuit and connected up to the rails in a similar manner.

The feeder connections between the track rail and the negative bus-bar connections in the sub-stations are of 2,000,000-c. m. capacity bare tinned copper cable. In some cases these cables are buried directly in the ground without protection, while at others, they run in vitrified clay ducts.

Conclusion.

The completed overhead line which has been described was first put in service on Apr. 27, 1905, and the third rail was first put in service May 13, 1905. Regular operation began on July 26, 1905. The operation of the transmission line and the third rail has been remarkably free from interruptions.

The design and construction of the transmission system was carried out by Westinghouse, Church, Kerr & Co., engineers for the Long Island Railroad Co., and the entire work was under the direction of George Gibbs, chief engineer of electric traction of the Long Island R. R., subject to the approval of an electrical committee, consisting of the chief operating officials of the road.

The Most Effectual Way of Stimulating Summer Travel.*

BY J. W. BROWN.

No two interurban roads face exactly the same local conditions, which conditions are very large factors in the handling of summer travel. One road widely advertises its through limited service and nothing is allowed to delay its crack trains, hence for this road large picnics with the inevitable extra cars and the consequent heavy draft on the power station, are not attractive propositions; yet for another road the picnic season is harvest time, and the lodge committee and Sunday-school superintendent are hailed with delight. This goes to show that our policies differ greatly and consequently no hard and fast rules for getting summer business can be laid down. However, there are several means of increasing travel that can be used in common by all roads.

We are selling goods just as truly as the merchant whose store faces our tracks; our line is transportation, his is something else, but they bear a close relation to each other. If we look at the tactics employed by a successful merchant in his efforts to stimulate trade we can gain some ideas that will apply to our own business.

First, he gets the goods; second, he advertises the fact that he has the goods; third, he displays them to advantage; fourth, he sees that his salesmen are up in their work, courteous and obliging.

Every road has some pretty spots along it or reaches some point of public interest. That's the goods. How about the advertising? Do you keep before the public the fact that these beauty spots and places of public interest are worth seeing and that your line is the best way to reach them? Advertising should be handled as carefully and judiciously as the purchase of supplies; it costs money to advertise and it should be done systematically.

The public needs to be kept informed of four things only, where to go, how to go, when to go, and the cost of the trip. Put before the people in a pleasing way the beauty spots and the places of interest along your line. Half-sheet posters done by an up-to-date printing house, in bright colors and displayed in prominent places will be found a good method of attracting attention. For special events, such as park openings, large 8 or 16-sheet bills are good mediums. Tell the public by means of good write-ups in the local papers what you have to offer. Newspaper stuff must be snappy and to the point to have value. Bills and posters must be kept clean and be renewed frequently.

After telling the people where to go and how to get there, the next most important point is to keep them posted on the schedule. Often a pleasure ride is not taken by the stranger because he does not know when the car leaves. Wall schedules are used by the West Penn Railways and have been found a very valuable adjunct to the regular pocket schedules, as they are consulted by traveling men at the various hotels. The time of arrival and departure of cars should be so kept before the public that no one can fail to know when and where to take a car. An arangement that has been tried and found productive of good results is to provide conductors and brakemen of intersecting steam railroads with schedules and also provide ticket agents with them. Business has been secured in this way.

The other thing the public wants to know is, how much will it cost for the trip? Special rates for round trips are greatly sought by the public. Organizations, schools, etc., send committees who paint in glowing colors what an immense crowd they will have and what a tremendous advertisement it will be for the road, if the rate is only bisected somewhere about the middle. Every special rate given is apt to establish a precedent that will be hard to get away from, and unless the business is done at a fair profit the advertising received will not be of much value when business is sought at a higher rate. Clean, attractive cars that arrive and depart on schedule time over a smooth road-bed, cars that are manned by courteous, intelligent and well-informed crews, are the best means of getting the travel, and will prove more effectual in the end than the spasmodic cut rate. However, the rates should be well known by the public, as the cost is frequently a deciding factor when a pleasure trip is under consideration. The hope of getting something for nothing is pretty strongly developed in the average person, and some particular stunts may be worked at times to attract a crowd. Once, and once only, can the same thing be worked in the same territory.

The writer once made use of a lot of old transfers to conduct a "transfer hunt" at an outing along the line. Several days before the outing the local papers began to talk about the transfer hunt and explained that at the picnic grounds there would be thrown away hundreds of transfers, numbered consecutively, one of which would bear the number 133,333, to the lucky finder of which would be given five dollars worth of transportation on the West Penn Rys. Bright colored cards with strings to attach to the buttonhole, similar to race track tags, were distributed the morning of the hunt, these cards setting forth the rules of the hunt and calling attention to the trips that could be made via the West Penn cars. Thousands of transfers were picked up and the number eagerly sought. The number 133,333 was finally found by a little girl, who was promptly paid five dollars by a merchant to whom the transportation was given. Devices of this nature, however, should be used sparingly, as the novelty will soon wear off.

Advertising is the best way to stimulate summer travel, not only by printers' ink, but by first-class car service, courteous employes and by giving the summer traveler such attractive surroundings that he gets off the car satisfied that he has made no mistake in traveling on your road.

*Read at the May meeting of the Central Electric Railway Association, Dayton, O., May 25, 1906.

The Cleveland, Painesville & Ashtabula R. R. Absorbed by the Cleveland, Painesville & Eastern R. R. Co.

It is announced that the Cleveland, Painesville & Eastern Railroad Co. has completed the negotiations for the purchase of the Cleveland, Painesville & Ashtabula Railroad Co. and has secured about two-thirds of its $1,000,000 capital stock at $20 per share. The Cleveland, Painesville & Eastern runs from Cleveland to Painesville, O., and the Cleveland, Painesville & Ashtabula runs from Painesville to Ashtabula, O. This purchase gives the Everett-Moore syndicate a through system from Ashtabula, O., to Detroit, Mich.

Program of the National Convention at Columbus.

Committees of the American Street & Interurban Railway Association, the Manufacturers' association and the Columbus Board of Trade held meetings in Columbus, O., on May 14th and 15th to discuss plans for the coming convention of the American association and its allied associations on October 15 to 19th.

The delegates were first taken to the proposed site for the convention at the State Fair Grounds. The Columbus Railway & Light Co. furnished one of its private cars for the trip. During the evening of May 14th the delegates were entertained at dinner by Mr Pirrung of the Board of Trade.

A meeting was held of the Committee on Papers and Topics, which meeting Secretary Swenson of the national association attended. It is now proposed that sessions of the Engineering and Accountants' associations be held on Monday, Tuesday and Wednesday of the convention week. The meetings of the national association will be held on Wednesday, Thursday and Friday and those of the Claim Agents' association on Thursday and Friday. On Wednesday morning it is planned to hold a joint session of the five associations, including the Manufacturers' association. This meeting will be addressed by the five presidents of the various associations. Meetings of all associations will be held both morning and afternoon.

The parent association will devote its Wednesday afternoon session to the reports of the standing committees. An interesting assortment of papers has been secured for the Thursday morning session in which interurban railway operation and management will be discussed. On Thursday afternoon subjects dealing with employes will be discussed. In this connection there will be read papers on welfare work, selection, instruction and discipline of employes.

On Friday morning the executive work of the association will probably be undertaken. Unfinished business and reports of the nominating committee and such other committees as were appointed during the convention will be in order on Friday afternoon and will close the convention.

THE
STREET RAILWAY
REVIEW

AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY
HUGH M. WILSON, TRUSTEE
1660 MONADNOCK BLOCK, CHICAGO, ILL.

Cable Address: "Railage." Long Distance Telephone, Harrison 27.

BRANCH OFFICES:
New York—150 Nassau St. Pittsburgh—510 Frick Building.

SUBSCRIPTION AGENCIES:
Austria, Vienna—Lehman & Wentzel, Karntnerstrasse.
France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XVI JUNE 15, 1906 No. 6

CONTENTS OF THIS NUMBER.

ELECTRIC RAILWAY REVIEW.

Beginning with the number for July the name of the "Street Railway Review" will be changed to "Electric Railway Review" and certain other changes believed to be in the interest of the patrons of the paper will be inaugurated. Not only does the change of management, announced in the issue for May, afford a convenient occasion for the introduction of improvements, but also it appears that the name of a journal devoted to the interests of electric railways may properly be broadened in a degree commensurate with the development that is taking place to so remarkable an extent in the interests themselves. The appropriateness of the change will appeal with especial force to those who have kept in touch with the broad idea underlying this development which is characterized by the rapidly increasing progress of electricity as a locomotive power, the relegation to the rear of other systems except for transportation over long distances, and the transformation of a convenient means of transportation over a city street to an imposing cross-country installation on its own right of way. A change of name based upon these considerations may well be supported by a careful treatment of principles as well as facts and by such a record of facts and events as will indicate what has already taken place as well as furnish a basis for forecast of what may be expected of the future. The monthly journal, under careful editorship and with the command of an adequate organization, should afford the opportunity for the presentation of a larger percentage of certainties in its so-called news departments than is ordinarily possible in the case of a paper published at briefer intervals. Such an organization and the capacity for such editorship the "Electric Railway Review" will possess. In this connection it is with pleasure that the publisher announces the appointment as resident editor in New York, of Mr. Daniel Royse, who was for nine years connected with the "Street Railway Review" and for half that time its editor. The editorial staff has otherwise been largely increased.

In addition to what are believed to be improvements in the subject-matter of the paper, some alterations in form and typographical character will be instituted with the July issue. In conformity to the generally accepted standards of size of periodical publications the "Electric Railway Review" will be 9x12 inches in page size. For the purpose of presenting as large a volume as possible of information within not unwieldy limits, its news departments and matters of brief mention will be set in smaller type. Its advertising pages will be reset, with a view to securing the most attractive and typographically artistic display possible. In short, no effort will be spared to establish the "Electric Railway Review" upon the high plane warranted by the magnitude and importance of its field. A continuance of the favor shown toward the "Street Railway Review" will be accepted as an acknowledged appreciation of the growing importance of the interests represented; an increase of that favor will be looked upon by the new management as an indication of the correctness of its views of the tendency of the times.

ELECTRIC RAILWAY TRAVEL IN PENNSYLVANIA.

The detailed report of the secretary of international affairs for 1905 relating to street railways in Pennsylvania, shows a considerable increase in electric railway travel. The statement is made that the total mileage of the roads reported for the year 1905 is 3,169, so that the electric railways of Pennsylvania, if extended in a single line, would reach from the Atlantic to the Pacific. In 1887 there were only 519 miles of street railways in the state. The trackage has thus increased more than six-fold in 19 years and many lines were under construction at the end of the year reported.

Nearly 25,000 men were employed in the operation of the roads and received $14,126,000 in wages during the past year. Nearly 900,000,000 passengers are carried annually by the electric railways of the state.

HIGH SPEED STEEL IN REPAIR SHOPS.

The growing use of alloy steels in general machine shop work suggests a more general adoption of high speed tools for electric railway repair practice than has thus far been attempted. Time is an important factor in all shop work. It is certain that it pays to save time by adopting the most modern equipment whenever this can be done without prohibitive expense. High speed steel is admittedly very costly from the investment point of view—a single tool for use on a tire lathe may cost eight dollars,—but this is by no means the whole story. The tool is the only part of the entire shop equipment that cuts into the stock; power supply, belted or group drive, variable speed motors, lighting facilities, etc., are auxiliary features in comparison with the working point of the machine tool. Hence the tool itself is the last place in the entire shop where first cost should outweigh economy of operation.

There is yet much to be learned about the high speed tool for general shop practice, but it is well established that heavy, roughing cuts from the material under treatment are the special field of high speed steel, however widely opinion may differ as to the desirability of using such steel upon the finer work. Not only is there a marked saving in the time of each cut with alloy steel; the tool has to be dressed much less frequently than is the case with carbon steel, and very little time is lost in setting and re-setting it. The amount of work which a high speed tool will turn out with a single dressing in comparison with a tool made of low capacity steel is often surprising. At the last convention of the American Railway Master Mechanics' Association Mr. J. A. Carney stated that a set of bolt cutter dies made of 10-cent tempering steel cost 26 cents and cut 100 bolts before dressing. A set of similar cutters made of 75-cent high speed steel cost 77½ cents, but cut 1,100 bolts before dressing, and enough tempering steel cutters to do the work would therefore cost $2.86.

A great advantage of the high speed tool is found in the fact that it ordinarily requires neither cooling nor lubrication; in some cases such tools have been run at nearly a red heat without trouble, although the red heat itself seems to be a critical temperature for most high speed tools. It is no small satisfaction to eliminate the inconvenience and expense of the lubricating system, although it must sometimes be used in working on small pieces to prevent the stock from becoming distorted. In many repair shops considerable difficulty is experienced in trying to overcome the lack of uniformity in the hardness of pieces which are to be machined. In finishing steel rods and cutting gray-iron castings it is often very difficult to machine the work without frequent trips to the grindstone if carbon or self-hardening tool steel is employed. With high speed steel the hardness or softness of the material seems to make little or no difference to the tool.

The nature of the work in hand largely determines the choice of tool steel, and in operations where there is very little cutting, in comparison with the time required for preparing the work and setting it in place, it may be that the time saved by the use of high speed steel will not pay for the increased cost of the tool. Time might be saved in grinding and setting the tool itself, but this would not in such cases warrant the scrapping of the old low capacity equipment. In the repair shop it is certainly worth while to see if the existing equipment of carbon steel machine tools can be speeded up further by direct motor drive or otherwise before deciding that a wholesale change to alloy steel is desirable. Sometimes the stock is of such shape that it cannot be held firmly enough to withstand the force necessary to get the full effect of a high speed tool, or again, in the machining of small stock reduplicated many times a day where there is relatively little cutting to be done, the carbon steel tool is usually fast enough when the attendant forces his production to the maximum limit of personal convenience.

It is often claimed that the additional power required to operate a machine tool equipped with alloy steel, coupled with the extra stresses and strains imposed upon the machine frame or bed seriously offset the advantages offered by the increased output per tool, but this is a defect in the machine equipment. It is almost always true that on light work an old tool can be speeded up sufficiently to enable a gain in time and cost to be safely made. Heavy work may require stronger frames, but in the light of general machine shop experience the electric railway repair plant cannot afford to overlook the possibilities of alloy steel tools at the present time. The turning of steel tires requires the very best tool steel for satisfactory results, and in all the miscellaneous roughing-out jobs which from time to time pass through a shop, speed is of prime importance. Street railway repair shop production is both regular and special; varied problems are constantly coming up for solution, especially on roads which are inclined to make equipment of one sort or another for experimental trials, and for this reason one could hardly desire a better field for the securing of more detailed experience and information about the behavior of alloy steel under all sorts of conditions. A piece of rolling stock is a dead investment while it is standing in the repair shop, and anything which can be done to restore it to service quickly deserves careful consideration. It would be unwise to replace all the carbon steel tools in a repair shop by high speed outfits, but nothing is more certain than the importance of trying the latter on the heavier jobs which come in.

ENGINEERING COLLEGES IN RAILWAY WORK.

For years the engineering colleges of America have had in view the development of their organization and equipment in those directions which would best enable them to make their methods of instructing students conform to the conditions graduates have to meet in practice. Following this idea the colleges have been prompt to seize opportunities for co-operation with commercial institutions and to embark in special fields that seemed to invite or even to require assistance such as a public educational institution might offer. By extension and specialization in pursuit of this policy the colleges have facilitated instruction of students by making them better acquainted with the conditions they will have to meet in the future, and at the same time have educated the public, especially that portion of the public to which engineering graduates have to look for employment, to a better appreciation of the money value of a college education. This last point is of perhaps as much importance to the employer as to the employe.

The transportation field by reason of its great and increasing magnitude has appeared especially attractive to several of our leading engineering colleges and they have established special schools or departments devoted to transportation subjects, sparing no pains or expense to secure experienced railway men for the corps of instructors and to make their equipments complete for the investigation of experimental questions.

The motive power department of a railway is in need of exact knowledge on a multitude of points, to investigate which requires experimental research. Because the machinery handled is bulky, heavy and complicated, and the forces dealt with are large, correspondingly heavy and complicated and at the same time delicate and costly apparatus is a necessary accessory for many investigations. This is especially true of the equipment required for shop tests of locomotives, and the steam locomotive testing plant established at Purdue University in 1891 is the most striking example of the extent to which the engineering college is prepared to go in its work of specialization in order to meet the needs of the transportation field. This plant, which was the first permanent one ever designed, was destroyed by fire in 1894, but the same year the university replaced it with an even more complete one. The work done in locomotive testing by Professor Goss at Purdue demonstrated the importance of tests in a laboratory where the effects of individual conditions can be isolated and measured, and one result was that two large American railroads later built permanent testing plants of their own. The Chicago & Northwestern in 1894 erected a temporary plant at South Kaukauna, Wis., and in 1895, a permanent one at its Chicago shops. In 1904 the Pennsylvania Railroad built the locomotive testing plant that was installed in the Transportation Building at the Louisiana Purchase Exposition and later removed to the company's shops at Altoona, Pa.

Since 1891 when the steam locomotive was first domesticated, if we may be permitted that term, for laboratory work, there has been an astounding change in electric railway motive power equipment, making desirable a similar laboratory for investigation of questions peculiar to the newer apparatus. While 15 years ago two 15-h. p. motors were considered an ample equipment for a large electric car, today four 125-h. p. motors for a single car are not unusual, and such an equipment obviously will present problems that cannot be investigated in the plants for testing individual motors, such as all the manufacturers and many electric railways have as part of their shop equipments.

This latest need for extended laboratory facilities has been met

by the Worcester Polytechnic Institute in planning its electric railway engineering laboratory, which is described on another page of this issue, and will contain an installation for testing electric locomotives. Some of the details of this plant, particularly the application of electric generators for braking purposes, and the addition of flywheels to the axles of the supporting wheels (which in the testing apparatus serve in lieu of track rails) in order to secure the inertia effect due to the weight of the car, are suggestive of interesting subjects for investigation and of the care shown in the design. The electric railway engineering department at Worcester will be under the direction of Mr. Albert S. Richey, who is especially fitted for this work by reason of his long experience as electrical engineer and chief engineer of the Indiana Union Traction Company.

In the matter of equipment for road tests of electric railway motive power the engineering departments of several institutions have provided themselves with special test cars which, besides being adapted for instruction of students, relieve railway companies of the expense and relieve railway officials of much of the work incident to fitting the railway's regular equipment for testing purposes. In passing, it is proper to say that the railways as a class have always been glad to provide apparatus needed for tests under the auspices of colleges; nevertheless the change must be a welcome one to busy officials.

Within the month we note that the University of Illinois has added to its Engineering Experiment Station equipment an electric test car, comprising a body of the interurban type, with four 50-h. p. motors and a complete outfit of accessory apparatus, recording instruments, etc.

The test car "Louisiana" which was built under the direction of the Electric Railway Test Commission of the Louisiana Purchase Exposition, with especial view to investigating the subject of air resistance (this car was described in the "Street Railway Review" for March 15, 1905) after the completion of the field work of the Commission upon the lines of the Indiana Union Traction Company, was deposited with Purdue University and is now available for experimental work in connection with its Engineering Laboratory.

Worcester Polytechnic Institute, as part of its newly designed Electric Railway Engineering Laboratory, is to have a test car, which it is intended to use for road tests as well as for tests on the permanent laboratory plant.

HOISTING FACILITIES IN SUB-STATIONS.

Many railway sub-stations are very deficient in hoisting facilities, and whenever it becomes necessary to remove transformers or rotary converter armatures for the purpose of repairs at the factory no little difficulty is encountered. All sorts of temporary tackle and blocking are pressed into service and in cases where it is necessary to make the change as quickly as possible there is considerable chance of damaging the equipment or the sub-station building unless an expert in rigging is at hand to direct operations. Without some sort of permanent hoisting facilities it is difficult to move a 500-kw. transformer weighing some 6 or 7 tons, and even a 200-kw. unit, weighing over 3 tons, requires not a little skilful handling for expeditious work.

Few engineers would recommend the installation of power-driven hoists in any sub-stations of ordinary size, as the occasions for their use are few and far between. Possibly a motor-driven crane is desirable in connection with installations of 10,000 or 15,000 kw. capacity and larger, as the cost of a moderate-speed crane complete is very small as compared with the entire sub-station cost, and a power-driven hoist is certainly a great convenience. There appears to be no good reason, however, why a chain hoist of the hand-operated type should not form a part of the equipment of every sub-station, and there ought not to be much difficulty in providing a run-way in the form of steel I-beams between the central portion of the machinery room and the doorway. The cost of stiffening the construction of the building sufficiently to support the weight of a transformer suspended from the run-way by a chain hoist ought not to be excessive, and the hand-operated hoist itself is relatively inexpensive. A 5-ton hoist of the speed-gear type should make it possible for one man pulling with a force of 80 lb. to gradually raise a weight of about 6,500 lb., and two men should be able to handle any of the equipment which might have to be moved. Care should be taken to install the hoisting equipment free from possible contact with high or low tension circuits. In some cases transformers can be installed on pedestals fitted with wheels, so that they can be rolled out if necessary. The best plan, however, is to provide some sort of mechanical hoisting facilities relatively inexpensive in first cost and insignificant in cost of maintenance and of operation.

GAS ENGINE TESTS.

The purchase of a large reciprocating steam engine or a turbine for a railway plant implies in most cases an acceptance test of greater or less elaboration. Methods of testing steam-driven prime movers are now pretty well standardized, but the testing of gas engines is still an unfamiliar task to many electric railway engineers. Gas engine plants for railway service are still relatively uncommon in comparison with steam plants, but the increasing application of internal combustion engines to this field renders this testing under service conditions a matter of growing importance.

The testing of a gas engine is a subject susceptible of almost indefinite elaboration, and from the standpoint of the street railway manager it is quite as important to know what to leave out in such a test as to know what is wanted. A test of an internal combustion engine from the point of view of the manufacturer is one thing, and a test with regard to the fulfilment of commercial guarantees, another. The former includes the latter in many cases, and if the purchaser is interested in the thermodynamic problem of the gas engine as a prime mover, it is well worth while to test its behavior in the most exhaustive manner possible, calling in the aid of engineering specialists who can handle the problem on the basis of trained experience in dealing with heat balance, compressions, quality of governing, temperatures during the cycle, and similar refinements. The higher the cost of the gas engine plant, the more likely it is that long and elaborate tests will pay for the making.

In many cases, however, the contract fulfilment is the only result which the operating company cares about. The problem is not to determine the maximum possible efficiency of the engine, or the effect of varied conditions upon plant economy. What is wanted is a simple statement of whether the engine delivers the required output at various loads with the guaranteed fuel consumption; whether it operates smoothly in commercial service, regulates its speed within the required limits, and in a general way constitutes an economical and reliable addition to the plant. If the gas is generated at the plant it is important to know its quality as regards thermal value, cleanliness, temperature and coal consumed, but the vital point in such a plant is the number of pounds of coal of given calorific power required per kilowatt hour at the switchboard. This is the basic figure of economy, just as it is in the gas engine plant which consumes gas drawn from a seller's main, in which case the question to be answered is how much power can be developed with a definite number of cubic feet of gas of known quality and price.

It is something of a disadvantage to be obliged to include generator and shaft efficiency in determining the economy of a gas engine plant under service conditions, but by sending a qualified representative to the factory for the purpose of witnessing tests of the separate units before shipment, sufficient data can be collected to enable a fair judgment to be obtained as to the individual efficiency of the engine and generator. The generator test is, on the whole, more important, for the performance of this part of the equipment does not depend upon the quality of the gas or other external conditions, so long as it is driven at the proper speed with ample power at the other end of the shaft.

The determination of the principal data in a brief gas engine test is a comparatively simple matter for the engineering department of a well organized road. If the plant is of the producer type it is generally necessary to run a test for at least twenty-four hours in order to determine accurately the amount of coal consumed. In any case it is important to know the heating value of the gas delivered to the engine, the temperature of the supply and exhaust, the speed regulation of the engine under load changes, the best proportions of air and gas to be admitted to the engine cylinder for compression, and the output. The gas consumption at various loads can readily be obtained by meter readings, an advantage yet to be realized in steam engine plants. It is desirable to take frequent indicator cards in a gas engine test, for these are very suggestive in locating flaws in the adjustment

of the engine, particularly with reference to the point of explosion. With uniform quality in the gas supply an ordinary tachometer suffices for the speed readings, but the continuous record afforded by the revolution counter should not be overlooked.

In engines of small or medium size, certainly up to 150 h. p., or over, the friction brake test can be carried out with little trouble, if brake horsepower is wanted, but in large railway plants the kilowatt hour at the bus-bars is really the essential unit of output. The heating power of the gas can be ascertained either by chemical analysis or by calorimeter test, and the temperature of the exhaust, which often exceeds 1,200 or 1,500 degrees Fahrenheit, by the use of the electric pyrometer or by calculation from known data and measurements. The Transactions of the American Society of Mechanical Engineers during the past five years furnish much interesting reading in reference to the working details of gas engine tests, but there is still room for the exercise of initiative in testing large direct connected units under service conditions.

THROUGH CARS.

The through car service on electric lines has been a popular one wherever instituted, for which there appear to be two principal reasons. The through car is usually a parlor car, having chairs in lieu of seats, and is operated on a faster schedule, features which add so greatly to the comfort of passengers that they willingly pay an excess fare. Also the through car obviates chances of delays at connecting points, besides relieving passengers of the trouble of transferring their hand baggage, making inquiries as to their cars, etc.

The through car is the natural development in territory served by a number of railways of comparatively small mileage and its name implies operation over the tracks of different companies—analogous equipment and service on the lines of one system would be designated "limited." Operation of cars over the tracks of different companies calls attention to several questions needing joint action for their satisfactory solution, and probably more than any other one thing is stimulating the activity of state and interstate interurban associations. Some of the points thus called to the attention of railway interests are the need for clearance standards, for standards in track construction, for uniformity in rules, and for agreement as to inspection and maintenance of rolling stock and interchange of car crews.

The slight interest taken by members of the national association in the work attempted by its sundry standardization committees was due almost wholly to the fact that there was in practice but little interchange of equipment. The through car bids fair to change this attitude.

THE RIGHT OF EMINENT DOMAIN IN MASSACHUSETTS.

A bill which directly concerns the construction of electric railroads is in the hands of the joint committee on railroads and street railroads of the Massachusetts legislature and it is understood that the committee will report favorably upon it. This bill is the outgrowth of petitions for charters to build electric lines with the right of eminent domain, made to the legislature about a year ago.

The bill provides that electric railroads may be constructed when in the discretion of the railroad commissioners public convenience and necessity require them and that such lines shall have all the duties, rights and privileges of railroad corporations, including the right to take by eminent domain. It provides that 15 or more persons may form an electric railroad company, one-half of which railroad shall be upon private land. The agreement of association shall state the corporate name which must contain the words "electric railroad company" at the end. The capital stock must not be less than $10,000 for each mile, and the par value not less than $100 per share. Within 30 days after the first publication of notice, the directors must apply to the railroad commissioners for a certificate that public convenience and necessity require the railroad, and must file a map of the line. If the railroad commissioners refuse to issue such certificate then no further proceedings shall be had, but application may be renewed in one year.

The aldermen or selectmen of the locality affected may prescribe where tracks shall be laid and the kinds of wires and poles and other appliances to be used. An electric railroad company may act as common carrier of baggage, express matter and freight subject to regulations and restrictions made by the local authorities with the approval of the railroad commissioners.

At present electric lines can take private property only to avoid some difficulty of construction or operation, but under this bill they may locate their lines as they see fit and put in operation high-speed electric trains stopping only at stated points. Under these conditions and in view of the privileges of such electric lines, the speed at which they can be operated and the low rate of operating cost the electric railroads will come into active competition with existing steam lines. It would seem that the bill involves possibilities that will largely revolutionize present transportation methods in Massachussets.

WHERE IS THE HOTEL?

Within a few years the value of advertising has come to be better appreciated by electric railways, largely because so many of them are engaged in operating pleasure parks, or because their lines are in territory attractive for excursions. One especial class of advertising that could not but appeal to the traveling public appears to have been entirely overlooked. We speak for the traveler entering a strange town via the steam railroads, who on his arrival needs information as to the location of hotels and how to reach them by street car. Many are those who reluctantly pay 50 cents for bus hire, when could they but know 5 cents car fare would serve equally well. Our suggestion is that a street railway company should have in every railroad station to which it runs, folders for distribution placed where they will be readily accessible, or wall signs, or both, showing by maps the location of hotels relative to the station, and giving short but clear directions as to what car lines should be taken.

MUNICIPAL OWNERSHIP IN GREAT BRITAIN.

The reports of several investigators who have been studying the results of municipal ownership in Great Britain, have been published recently. These investigations were made with the view of determining whether the practical results obtained in the British cities were favorable to the adoption of the same policy in the United States. Elsewhere in this issue appears a review of a work entitled "Municipal Ownership in Great Britain," by H. R. Meyer, at one time professor of political economy in the University of Chicago. While Professor Meyer does not reach any definite conclusion, his investigations seem to point unfavorably towards municipal ownership in the United States.

Another report recently published appeared in the "Journal of Political Economy" for May. It is by Everett W. Burdett of the Boston bar. He finds that the "continued exploitation of private business by private capital rather than the entrusting of business or quasi-business enteprises to municipal officials, is the only sound course to be pursued in the United States." One of the faults found with public ownership is the creation of an army of public servants who exercise an undue influence in municipal elections for their own gain and against economical government. Another objection made to public ownership is that municipal corporations have not been able to operate as economically as private corporations and the charges to the general public have been higher.

In summing up the matter Mr. Burdett finds that the operation of public utilities by British municipalities has been successful, if at all, in the single particular of furnishing the service or supply at a fair price to a comparatively few persons. The municipal supply of electricity for light, track and telephone service has been attended by certain undesirable results which include a serious check upon the general development of electrical industries in Great Britain, an extremely restricted supply in cases where the work has been undertaken, the abnormal enlargement of the functions of local government resulting in the discouragement of private enterprises, the creation of a large and increasing body of office-holding voters, and a most serious enlargement of municipal indebtedness.

In conclusion Mr. Burdett finds that it will be impossible to duplicate the financial and technical results of British municipal undertakings in America owing to the totally different political conditions obtaining in the municipalities of the two countries.

THE FRINGE OF HIGH FINANCE.

"New incorporations" comprise an important part of the news department of a railway paper, but those who have occasion to note carefully the new organizations, especially if for business reasons an effort is made to keep informed as to the progress of these enterprises, must be surprised that so many concerns get no further than organization, and wonder why the promoters did not profit by the experience of others who had failed in similar undertakings. The principal cause for the abnomally large infant mortality among railway corporations is that the promoters of the new enterprises are the victims of malpractice on the part of wildcat concerns making a specialty of this field. As the methods of these self-styled engineers and financiers who prey upon the credulity of the inexperienced promoter are not well known outside of banking circles, a brief statement concerning them should be of general interest.

One of the peculiarities of human nature is the ease with which a man can be persuaded to embark in a new enterprise of the principles or details of which he knows nothing, upon representations so flimsy that their absurdity would be detected at once had the matter to do with his own regular business. Because of this fact farmers, merchants and professional men, without instruction or experience in railway matters, are prone to argue that the lack of transportation facilities in a specific territory of itself demonstrates that a new railroad to connect the district with some nearby railroad would pay, and thereupon follow discussions of the matter before neighborhood meetings and in the local press. The few miles of road to be built will cost say $200,000 and the leading citizens interested can raise only $20,000; the plan contemplates selling some bonds when success is assured.

Thanks to the efficiency of the press clipping bureaus, interested persons are soon informed as to the talk about a new railroad and at once write the men stated to be most active in the matter. The wildcat broker is fully as prompt as bona fide engineers, and if his first letter is answered the local men are informed that "the project looks promising, but we can do nothing until one of our experts has inspected the territory, which will involve an expense of $250." The $250 being forthcoming the expert visits the territory and reports that the "project is all and even more than is claimed for it"; the promoters are then told that the next step necessary is to make maps of the proposed route, which work will cost $1,500, and which had best be done by certain engineers (who are in partnership with the broker). Next the formal incorporation must be looked after, and this being very important work, the promoters are urged to entrust it to a law firm highly recommended by the broker (and also in partnership with him). The original $20,000 of real money being thus further depleted, the next opportunity comes when the bond issue is printed (the printing being done by another ally of the broker).

Next comes the grand coup, when it is explained to the directors of the new company that in order to market the bonds it is necessary that they be guaranteed by a trust company, and that the Cosmos Securities Company (another co-worker of the broker) will guarantee the entire issue; this will cost 5 per cent, but the expenditure is "absolutely necessary, because no one will buy a bond unless it is known to be good, and a big trust company like the Cosmos will give the needed assurance," etc. It naturally takes much persuasion to get the guarantee fee of $10,000, but the victims have been skilfully educated up to this point, and the effort is too often successful.

The broker, being intrusted with the sale of the bonds, departs, ostensibly for the money centers, while the directors of the embryo railroad continue to build air castles. At first telegrams are confidently expected; failing these, letters are awaited with impatience; finally a part of the little capital remaining is used to send a committee to investigate; all the committee learns from the broker is that "there does not appear to be any market for our bonds at this time." The money subscribed being expended, the project is abandoned.

The moral to be drawn from this is that those who contemplate the promotion of a railroad should inquire most carefully into the integrity and responsibility of their advisers. Swindles of the type described are perpetrated so frequently that some of the larger banking houses have organized special departments for the investigation of brokers, promoting and development companies, and other concerns (nearly all of which have high sounding names and luxurious offices) that are taking advantage of those inexperienced in the ways of bona fide railroad promotions.

Work of the Traffic Promotion Committee.

The Committee on Promotion of Traffic of the American Street and Interurban Railway Association, which was appointed at the 1905 convention of the association and authorized to investigate the general problem of how to increase the receipts of railway properties, has issued to the general managers of all street and interurban railways of the United States an eight-page information blank with a view to obtaining a full discussion of the various means employed to stimulate traffic on their respective lines.

These blanks which managers are requested to fill out and forward to the secretary of the association, Bernard V. Swenson, 60 Wall St., New York, ask for complete detailed information in regard to publications, schedules, advertising, special cars, excursions, amusement parks and special attractions, etc., and are intended to furnish a basis for the report of the committee at the 1906 convention at Columbus in October.

The Committee on Promotion of Traffic consists of: W. E. Harrington, New York, chairman; H. F. Grant, Seattle; and H. E. Reynolds, Boston.

Traction Developments in Chicago.

Since the refusal of the Supreme Court of the United States to grant a rehearing in the 99-year case, the most important developments in the traction situation in Chicago have been in connection with plans for tunnel lowering, the electrical equipment of the cable lines and the formation of a new company to take over the interests of the Union Traction and its underlying companies.

On May 24th the committee on local transportation of the city council recommended for passage the ordinance allowing the Union Traction Co. to trolleyize its cable lines.

The disagreement over the manner of reconstructing the La Salle and Washington St. tunnels has been adjusted. The engineers for the city and for the traction companies have come to an agreement as to the form of construction to be adopted. It has been decided to use the I-beam form of roof construction.

A meeting of the sub-committee of the city council on South Side trolleyizing was held on May 22nd. President Mitten and his engineer expressed a willingness to abandon the cable and substitute temporary trolleys if a basis could be reached justifying the expenditure. The situation differs on the South Side from that in the Union Traction field because there are no tunnels and under the Supreme Court's decision it is questionable whether the city can take over the cable lines without paying for them as an operating system.

On June 6th a most important development in the situation occurred. On that date the Chicago Railways Co. was organized in New York to take over all the properties, not only of the Union Traction but the West and North Chicago companies, and to represent all the formerly warring interests. It is understood that this company will negotiate with the city and undertake the reconstruction of the traction lines. The officers elected were: President, Frederick H. Rawson, president of the North Chicago Street Railway Co.; vice-president, Henry A. Blair, receiver for the North and West Chicago Street Railway companies. A meeting of the new company will be held shortly, at which a board of directors will be chosen.

The stock of the new company is to be held in trust pending the decision of the federal court as to the relative rights of the Union Traction and the underlying companies. When fully organized the company will be in a position to deal directly with the city on all matters of controversy between it and what are now termed the Union Traction interests.

The Chicago Railways Co. was originally organized under the laws of Illinois at the time of the dispute between the Union Traction and the underlying companies as to the terms of the revised leases. It had a nominal capital of $10,000 and was incorporated with the idea that it might at some time be needed. This time seems to have arrived.

Roller Bearings.

At a recent meeting of the British Tramways & Light Railways Association, Thomas W. How presented some interesting results of comparative tests of cars equipped with roller bearings and of those equipped with the ordinary type of journal. An abstract of these results follows:

The importance of reducing frictional resistance both in starting and running is now fully acknowledged, and is emphasized by the use of the many anti-friction metals and special devices for improved lubrication of axles and shafts. Whatever degree of success the best of these devices may have attained, they cannot approach such favorable results as are undoubtedly produced by the application of properly constructed roller bearings.

While it is true that many experiments have been made with a large variety of roller bearings and many failures have resulted, such failures have been largely due to insufficient experience or a very limited application, while conversely there have been many successes. The requirements of a satisfactory roller bearing are that the various parts must be proportioned with reference to their relative movements, so that nothing but rolling motion takes place between the surfaces engaged, and further, that they must be constructed of materials suitable to withstand the stresses imposed upon them. With reference to this latter point, it is of undoubted advantage to have all the moving surfaces of hardened steel, which, for heavy loads, must be of high-class, hard, and yet fibrous quality in order to miminize friction and present the greatest resistance to wear. The principle difficulty in this case is first cost. When running on unhardened surfaces and with comparatively light loads the rollers may be of milder steel of good quality not necessarily hardened; but in case of very heavy loads upon comparatively small diameters with restricted length, for the purpose of ensuring sufficient durability, it is essential either to run on well case-hardened shafts or journals, or to cover the latter with a steel sleeve of the same temper as the rollers. For all such purposes the steel must be carefully selected to suit the conditions it has to meet, and be hardened and ground to an accurate diameter in order that the bearings may run absolutely true on their surfaces. The bearing rollers must also be kept parallel with the axis of the axle or journal upon which they roll, they must not be allowed to touch each other, and must be of sufficient diameter, length, and hardness to bear the fatigue of the duty they have to perform. Upon true parallelism greatly depends the success of roller bearings in practice.

The device for spacing the rollers which, in the author's opinion, is the one most likely to survive, is the floating cage. Its great recommendation is its simplicity, and the ease with which bearings so constructed can be taken off and replaced in position. The roller cage is a gun-metal casting, having parallel bars forming spaces wherein solid rollers are kept strictly parallel to the shaft and are prevented from cross-winding. By this particular device the only sliding friction is that due to the rollers touching the bars of the cage, and as the cage rotates much more slowly than the shaft the resistance to motion of the cage is very slight.

Extensive experience has amply proved that the solid form of roller is by far the most satisfactory in the long run, and better suited to the other plain load-bearing surfaces, the whole of which with solid rollers is simply subjected to a slight extra planishing which is more beneficial than otherwise to those surfaces. The resisting power of the roller, as far as the author's experience goes, increases as the square of its diameter; and, where shafts or journals are of unhardened steel, he is of the opinion that a greater load than 200 lb. per lineal inch should not be placed upon rollers of, say, ¾ in. diameter or 800 lb. per lineal inch on rollers of 1½ in. diameter. As a general guide, however, the author considers the roller length of any bearing should not be less than two diameters of the shaft or the journal, and anything beyond that length would be a decided advantage.

Adequate provision must be made to meet the end-thrust or tendency to lateral movement, not only of the rollers and other moving parts themselves, but also of the axle or shaft when revolving within a fixed bearing, or of the bearing itself when revolving upon a fixed axle. Another requirement is that a roller bearing as a whole must contain few working parts. These parts must be as simple as possible, and they must be so designed that they can be applied and adjusted by any intelligent workman. Other important essentials are, that roller bearings must be produced at a reasonable cost; that they can be trusted to work without special attention; and that they are capable of performing an extended duty either in mileage or in number of revolutions at a small charge for maintenance.

In the earlier application of roller bearings sufficient regard was not had to the conditions under which the bearings would have to run; nor, as far as the author is aware, were those conditions generally known or properly understood. The result, in almost all cases where the practical application of roller bearings was introduced, was that there was too much rigidity with the bearing seatings, and that insufficient allowances were made for deflection, or want of parallelism in the shaft itself, or for equalization of load and adjustment of the bearings. The failure alluded to led to the discovery of a means whereby the rigidity of the bearings could be overcome; and a universal swivel seating was secured which, working within a circular steel case containing the cage and the rollers, enabled the bearing to freely swivel at the center and thus to accurately adjust itself over the full length of the bearing surfaces instead of at one or more points only.

With regard to lubrication for the rolling motion of the load-bearing parts, practically no oil is necessary, and as the oil is thoroughly distributed over the whole surfaces of the bearing by the action of the cage and rollers, a very small and constant supply only of mineral oil is required for cage ends, spokes and thrust-pads. It is claimed and generally accepted, that about 80 per cent in oil consumption is saved by the use of roller bearings.

In railway vehicles fitted with roller bearings the starting effort has, in nearly all cases where a series of tests has been made, been found to be as low as three pounds per ton of load, giving a coefficient of friction of .0013: this includes the wheel friction upon straight level rails. It may be taken as proved that the reduction of frictional resistance results in an equally great reduction in coal consumption, electrical energy or other motive power, great economy in lubrication, no heating, and a minimum of supervision. The reduction in effort required to start vehicles is of such importance that, if it were the only advantage, it would justify the additional monetary expenditure necessary for bringing about the required economies. In the case of electric traction, the reduced starting effort is of the greatest importance; as, not only does it effect a very considerable saving in electrical output, but it also greatly reduces the rush of current at the moment of starting.

A series of tests was made with roller bearings, in April, 1899, upon two electric cars, one car having roller bearings applied to each of the four axle-boxes and the other car having ordinary bearings. There were in all ten persons on each car when tested. The weight of car was 8.5 tons; length of line, 2⅞ miles; rise of line, 611 ft.; gage of line, 4 ft.; diameter of wheels (4), 30 in.; wheel-base, 6 ft.

The first car tested was the roller bearing car No. 14. The up journey was made in 17 min. 40 sec., during which period 107 current readings and 107 voltage readings were taken. The next car tested was No. 6, having ordinary bearings. The up journey was made in 16 min. 37 sec., and 100 readings of each kind were taken.

The following table gives the comparative results:

	Up Journey. Foot tons.	Per cent
Ordinary bearing car	7,897 =	100.0
Roller bearing car	7,234 =	91.5
Excess required by ordinary bearing car, or saving effected by roller bearings	663 =	8.5
Losses in ordinary bearing car	2,246 =	100.0
Losses in roller bearing car	1,583 =	70.0
Difference	663 =	30.0

A Board of Trade electrical unit = 1,185 foot-tons of energy, hence the saving by means of the roller car is 4.56 Board of Trade units.

After deducting the power required to overcome gravity, the car fitted with ordinary bearings absorbed 2,246 foot-tons against 1,583 foot-tons in the case of the car fitted with roller bearings. These figures show that on the level there would have been a gain of 29.5 per cent, the whole of which is due to the reduction in journal friction. This reduction is equal to a saving of 10.8 lb. per ton per foot-run.

This saving amounts to about 50 per cent of the journal friction.

The figures show a saving of about one cent per car mile during the time the current was on. In the case of a car running 80 miles per day on 300 days per annum under the ordinary conditions requiring the current to be used in both directions this saving would amount to: 80 × 300 × .01 = $240 per car per annum.

In August, 1899, further experiments were made under almost similar conditions on the Birmingham Electric Tramways, with the following results:

Percentage of saving resulting from the use of roller bearings in pounds of tractive force per ton of load:

	Ordinary Bearings.	Roller Bearings.	Saving per ct.
To town	34. 8	30. 4	12.63
From town	37.22	24.12	35.20
Round trip	36.01	22.26	24.30

Assuming that each car runs 12 trips (72 miles) on 300 days the saving in electrical output in units per annum is 3,726 units. Taking the cost of the unit as about 4 cents, the saving per annum is $149.04.

In the trials above referred to, the roller bearings were applied to journals of the two car axles only, and highly favorable results would also accrue from the application of roller bearings to the armature shafts and for motor suspension upon the axles. The total motor losses of 25-h.p. motors at about nine m. p. h., which to a large extent are independent of axle journal friction, may be considered as fully 25 per cent loss of current, and since an important reduction in the friction of several parts must favorably affect the whole, possibly an average general saving of at least 10 per cent of current will be effected by the use of roller bearings throughout.

Much more recent tests have been made with the newest form of roller bearings upon tramcars at Southport with the following results. With roller bearings: The average energy consumption over the whole of the trials was .55 units per car mile. The mean speed of the cars was 10.3 m. p. h. The mean current consumption over the whole run was .389 units per car mile. With ordinary bearings: The consumption of energy over the whole run was slightly over one unit per car mile. The mean speed was 8.6 m. p. h. The mean current consumption was .797 units per car mile. Thus the mean current of ordinary bearings being .797 units per car mile, and the mean current of the cars with roller bearings being .389, leaves .408 units per car mile saving due to roller bearings without calculating the difference due to higher speed. The estimated car miles per annum being 400,000, the total saving in units amounted to 163,200 units. 163,200 units at 4.06 cents per unit = $6,625.92 per annum, which, divided by 20 cars, is equal to a saving of $331.29 per car per annum in electrical energy. This high percentage of saving is not generally obtained, and may be due to the exceptional character of the road and, to some extent also, to the class of motor employed. These bearings have been in constant service for over four years, and their maintenance, in renewals, has cost about $5.33, as against the above saving of $331.29 per car per annum.

Still more recent tests have been made at Wolverhampton and Croydon, with the following results: At Wolverhampton the test was made with a track cleaning and watering cart, over a series of runs on the surface-contact system of the Wolverhampton Corporation Tramways. The respective average results were 2.7 units per car mile with plain bearings and 2.3 units per car mile with roller bearings, the difference in favor of roller bearings being 15 per cent.

On the Croydon Corporation Tramways the tests were made as recently as the 8th and 9th of October, 1905, upon two cars, one being fitted with roller bearings and the other with ordinary phosphor-bronze bearings, the weather and track conditions being precisely the same. The two cars selected were those of the double-deck, Brill maximum-traction-truck type, identical in general construction, and weighing, when empty, 10 tons. During the tests both cars were loaded (inside) with 3 tons dead weight, equal to, say, 53 passengers. The route covered in each case was 11 miles. In the case of the car fitted with ordinary bearings 47 stops were made during the round trip, and the current consumed was 9.90 units, equivalent to .90 units per mile run. In the case of the car fitted with "Empire" roller bearings 44 stops were made during the journey, the current consumed being 8.30 units, equivalent to .75 units per car mile, thus showing a saving of 15 per cent in favor of roller bearings.

Records have been kept of the run of these cars from the start, and between Oct. 1, 1904, and Sept. 30, 1905, 14 of the bogie cars on the Croydon system, fitted with roller bearings, traveled 545,898 miles, and one car, fitted with ordinary bearings, ran during the same period 30,988 miles, the total mileage run by the 15 bogie cars being 576,886 miles. Assuming that the 14 bogie cars had not been fitted with roller bearings the extra current consumed, based on the difference as obtained from the two tests, would have amounted to 79,155 units, and at the price paid for the same, namely, 4.06 cents per unit, is equal to the sum of $3,213.66, or $229.55 per car. Taking the cost of renewals at 10 per cent per annum, which is a liberal allowance, and a further 10 per cent for depreciation, there still remains a saving of $183.64 per car per annum, due to the employment of roller bearings.

Change of Operating Methods in San Francisco.

The Board of Supervisors has passed an ordinance granting to the United Railroads of San Francisco the privilege of operating the street railway line on Market St. from the ferries to Valencia and on Sutter St. as far as Van Ness St., by means of overhead trolleys. The Market and Sutter St. lines have heretofore been operated by cable. The company maintained that it would require some time to reconstruct the cable road and that an overhead trolley system was the quickest way of restoring the transportation facilities.

This action on the part of the supervisors would seem to settle the question of the method of operation of the street railways in San Francisco and indicate the passing of the cable road. When the work of reconstruction is finished, the only lines that will be operated by cable will be those which traverse streets on which the grades are too steep for the operation of electric cars. The passing of the cable lines in San Francisco may be taken as a forceful illustration of the good that often results from a great disaster.

Accident in the New York Subway.

On June 1st, as the result of a collision on the storage track in the New York Subway between 107th and 108th streets, three empty cars were badly burned and traffic on this branch interrupted from 5:50 p. m. until 9:10 p. m. No person was injured. In this portion of the subway there are three tracks, the middle one being used for the storage of cars. At 5:45 p. m. an empty train run in from the north collided with four empty cars on the storage track, derailing three trucks and crushing the platforms of three cars. The middle one of the cars was of steel, the others being of the copper-sheathed composite construction. While the derailed trucks did not touch the third rail, short circuits and arcing were caused in all three cars by the demolition of the platforms. The wood in the sides of the copper-sheathed cars burned, filling the subway with smoke for two or three blocks each way, until the fire was extinguished by firemen working through the openings to the street above. The lighting of the subway is by separate circuits and no lamps except those directly above the burning cars were affected, these failing after about 30 minutes because the cables burned and some globes were burst by the heat. The subway is equipped with devices, placed every 400 ft., for tripping the circuit breakers controlling current supply to the third rail, and two of these, one at 103rd street station, were operated almost simultaneously within four minutes after the collision. While the metal sheathing proved a protection for the wood in the composite cars, this accident demonstrates the superiority of the all-steel cars which are now the standard of the Interborough company.

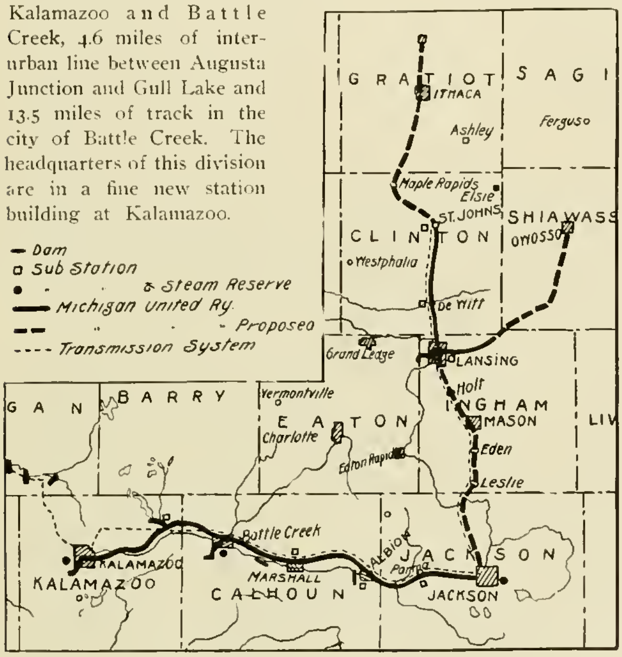
The recent arrival in Toledo of a Western Ohio railway car attracted considerable attention for the reason that it was the first interurban car bearing the name of that road, to make its appearance in Toledo.

The Kansas City & St. Joseph Electric Railroad Co. has appointed S. A. Phillips of Philadelphia its exclusive fiscal agent. This railway will connect Kansas City with St. Joseph. Twenty miles of the road, from St. Joseph to Dearborn, are graded. The entire length of the line is 49 miles, whereas the length of the steam roads from Kansas City to St. Joseph is 71 miles.

Some Operative Features of the Michigan United Railways.

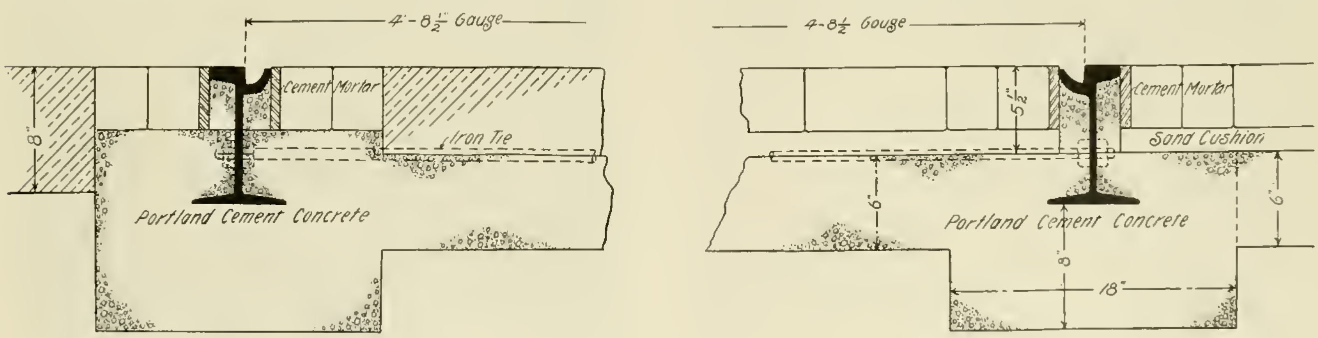
During the past month the Michigan United Railways Co. came into control of several electric railway properties in central Michigan, including the Michigan Traction Co., at Kalamazoo, the Jackson & Battle Creek Traction Co., the Lansing & Suburban Traction Co. and the uncompleted property of the Lansing & Jackson Railway Co. A brief description of these properties and some of their operative features may be of interest.

The Michigan Traction Division includes 17.5 miles of track in the city of Kalamazoo, 24.6 miles of interurban line between Kalamazoo and Battle Creek, 4.6 miles of interurban line between Augusta Junction and Gull Lake and 13.5 miles of track in the city of Battle Creek. The headquarters of this division are in a fine new station building at Kalamazoo.



MAP SHOWING LOCATION OF THE INTERURBAN LINES OF THE MICHIGAN UNITED RAILWAYS CO. AND TRANSMISSION LINES OF THE COMMONWEALTH ELECTRIC POWER CO.

The 17.5 miles of city track in Kalamazoo have recently been repaired and a large portion rebuilt. The new track work in the paved streets has been built according to the design shown in the accompanying illustrations. In this type of concrete-girder construction a 104-lb. grooved rail with 12-bolt joints has been used. This rail is 9 in. high and has a base 5½ in. wide. The new track is bonded with two No. 0000 bonds, one 10 in. and one 7 in. long. These bonds have expanded terminals ⅞ in. in diameter. It is interesting to note that the management specified that the holes for the bonds be punched at the steel mill. These holes were first made 13/16 in. in diameter and later reamed dry to a ⅞-in. diameter at the time of bonding. In this way clean holes were assured for affording perfect bonding contact. The track rails are tied together with ¾-in. round rods placed 7 ft. 6 in. apart. It will be noted that in one illustration the pavement shown is asphalt and in the other it is brick. With each kind of pavement brick "stretchers" were laid parallel with the rails. The space between these bricks and the rails, after the street surface had been completed, was thoroughly grouted with a mixture of portland cement and sand. The concrete stringer forming the bed for the track was made of a one-to-six mixture. This type of track construction connects with hard-center special work built of 9-in. grooved rails.



MICHIGAN UNITED RAILWAYS CO. STANDARD TRACK CONSTRUCTION IN STREETS PAVED WITH ASPHALT AND BRICK.

The interurban line between Kalamazoo and Battle Creek is now being repaired, the bridges are being rebuilt and a large number of ties and much new ballast will be placed. At several of the terminals Ys and loops will be built and additional feed wire will be erected so that when the proposed limited service is started it can be properly maintained.

In Kalamazoo 19 regular city cars are in operation furnishing 10, 12 and 15-minute headways on the various routes. Universal transfers are issued. It is frequently necessary to operate extra cars between the city, the recreation and ball park, 1½ miles east of the city, to which there is a double track, and also between the city and Lake View park, 2½ miles southwest of the city, which is owned by the company and operated under special management.

The rolling stock of the Kalamazoo city lines and a portion of the cars operated over the interurban line to Battle Creek are stored and repaired in the shops at the eastern city limits of Kalamazoo.

One of the interesting shop kinks to be found at this shop is a home-made sand drier. Heat for this drier is furnished by an ordinary hot water car heater installed in one corner of the storage barn and supplied with water from the shop piping. By utilizing a number of sections of old car heater piping and embedding these in the form of coils placed in the brick floor of a sand bin, it is possible to dry a comparatively large amount of sand in a short time.

The present rolling stock equipment at Kalamazoo consists of twenty-six 21-ft. single-truck, semi-convertible cars, twenty 10-bench, double-truck open cars, and ten 45-ft. interurban cars, each equipped with four G. E. 57 motors. There are also now being equipped for service four new 45-ft. interurban cars built by the Niles Car Co. The new cars are mounted on Baldwin M. C. B trucks with steel wheels and each is equipped with four Westinghouse No. 93 motors. The interior of these cars is divided into two compartments with a combined seating capacity for 46 passengers No accommodation is afforded for handling baggage, as it is the policy of the company to carry trunks on the regular express trains. Two baggage and express trains are operated each way per day. The new cars will operate as local trains between Kalamazoo and Battle Creek. It is interesting to note that between these two cities there are 98 regular stops, of which it is necessary to make 35 on the average run.

There are four more cars now being completed for operation on the Lansing and St. Johns Division. The latter cars will be similar to those that have been described, except that they will be mounted on Peckham M. C. B. trucks and equipped with four G. E. 80 motors. All the cars are designed for single-end operation and have toilet rooms at the rear ends.

The interurban division between Kalamazoo and Battle Creek is equipped with a metallic circuit telephone line and booths at all sidings. The cars are handled by a dispatcher located at Battle Creek. The schedule for the run of 24.6 miles is 90 minutes and cars are operated on a 45-minute headway. In the near future there will be a limited service established between Kalamazoo and Jackson over the tracks of the two divisions. These cities are 71 miles

apart and it is proposed to make the running time between them two hours and thirty minutes. This will necessitate the running of the cars from Battle Creek to Kalamazoo at a scheduled speed of about 25 miles per hour.

During the summer months a considerable amount of excursion business is carried to and from Gull Lake over the branch line from Augusta Junction, which is on the interurban between Kalamazoo and Battle Creek. This branch line is 4.6 miles long and has as its northern terminus the town of Yorkville, located on Gull Lake, a body of water about seven miles long and two miles wide. Around the shores of this lake are many hotels and resorts which contribute a substantial traffic throughout the summer months.

LOCOMOTIVE BUILT AT THE LANSING SHOPS OF THE MICHIGAN UNITED RAILWAYS CO.

In Battle Creek there are 13.5 miles of city track. The standard track construction here is 72-lb. Shanghai T-rails laid on white oak ties spaced two feet center to center. Continuous rail joints and two No. 0000 bonds are used. In the Battle Creek city service there are eleven regular cars operating on 12 and 15-minute headways. The city equipment consists of fifteen 21-ft. semi-convertible cars and ten 10-bench open cars. A considerable amount of summer traffic is handled from the city to Goguac Lake, 2½ miles south of the city limits. There is double track on this line with a loop and facilities for rapid loading and unloading of large crowds. The headquarters of the Battle Creek city division are at the interurban station near the center of the city.

Jackson & Battle Creek Division.

The interurban division of the Michigan United Rys. between Jackson and Battle Creek is a well built high-speed line 46 miles long, operated for 36 miles of this distance by third rail and the remainder by trolley. A generous amount of earth work was handled in the construction of this line, so that the grades are not severe and as the curves are not sharp limited cars may be operated at high speeds. The track is laid with 70-lb. rails and current is conducted to the cars through a third rail of like weight, except through the cities, where there is a substantial type of overhead construction. At all the turnouts there are non-spring switches with high targets and electric signal lights.

As there are a large number of local stops at highway crossings where the break in the third rail is short, signal posts have been erected at a proper distance on each side of the stopping platforms so that a motorman may know just where to stop his car. These posts are two by four inches in section, painted white, and extend up about four feet above the surface of the ground. They are so placed that when the front platform of the car is opposite one of them the rear platform is at the proper point for loading and unloading passengers. At many of the stopping points between Jackson and Battle Creek there have been erected small shelter sheds of a simple design. These structures are painted white and present a pleasing appearance.

The equipment for the Jackson & Battle Creek Division includes five 50-ft. interurban cars of the so-called "local" type. These cars have baggage compartments and are equipped with four G. E. 57, 50-h. p. motors. There are also five 59-ft. cars of the "limited" type, each equipped with four G. E. 66, 125-h. p. motors. The cars are built for single-end operation. The limited cars have no baggage compartments and are arranged with observation windows and a small motorman's cab at the front end.

Local cars are operated between Jackson and Battle Creek on two-hour headway, making the run of 46 miles in 150 minutes. Between these cars, leaving the terminals on the even hour, are limited cars which make but three station stops in the entire distance and are scheduled to run the 46 miles in 90 minutes.

Freight service is operated with two trips per day between Jackson and Kalamazoo. At Jackson there is a transfer arrangement with the interurban lines to Detroit, so that freight and express shipments may be billed through for the entire distance.

As a means of inducing Sunday travel there has been distributed a large number of advertisements stating that reduced rates are offered on the interurban lines for Sunday round trips. This practice induces a considerable amount of excursion traffic.

Jackson & Lansing Division.

The new interurban line between Jackson and Lansing, of which there are now seven miles graded, will be 38.5 miles long. The right of way for the entire distance has been obtained and a high-tension pole line built along the new location. When this new division is completed there will be a physical connection between all the properties of the controlling company.

Lansing & Suburban Division.

The Lansing & Suburban Division, with headquarters at Lansing, includes 12 miles of city track in Lansing and the interurban lines from Lansing to St. Johns, 20 miles, to Pine Lake, 9 miles, and to Waverly Park, 3.5 miles. In the city of Lansing the standard track is laid with 72-lb. Shanghai T-rails with continuous joints and two No. 0000 bonds. The various interurban lines are of standard roadbed construction of a recent type.

In the city of Lansing cars are operated on 8 and 12-minute headways. For this service there are fourteen 21-ft. semi-convertible, double-truck cars and fifteen 10-bench open cars.

The Lansing-St. Johns line is 20 miles long and cars are operated under 90-minute headway. The rolling stock equipment for this line is similar to the new interurban cars just being put on the Kalamazoo-Battle Creek Division. As the territory between Lansing and St. Johns is unoccupied except by the electric line, quite a satisfactory amount of freight traffic is handled.

OFFICE, SHOP AND WAREHOUSE, LANSING & SUBURBAN TRACTION CO.

The Lansing & Suburban Division caters quite extensively to excursion traffic as it owns two parks. Waverly Park, which has been mentioned, is at the terminus of a line extending three and one-half miles southwest of the city. This park is 73 acres in area, located on the Grand River, and supporting a hotel and many modern amusement attractions. At the terminus of the Pine Lake line, nine miles from Lansing, the company owns a 10-acre property on the lake shore. This

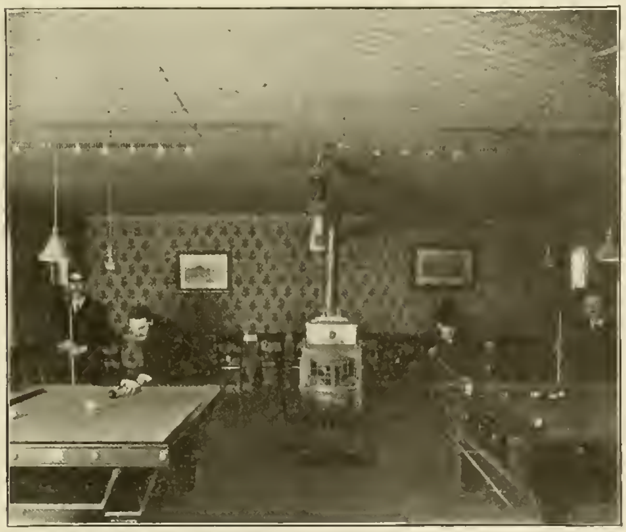
property has been improved and there are to be found here docks, pavilions, amusement attractions and electric launches.

The locomotive car shown in the accompanying illustration was built at the Lansing shops for use on the various lines of the Lansing & Suburban Division. This locomotive consists of a standard 34-ft. steam railway flat car mounted on M. C. B. trucks and 34-in. wheels. It is equipped with four G. E. 73, 75-h. p. motors. There are two cabs, one at either end of the car, each covering 5x8 ft. of floor area. The framework and sheathing of these cabs are of sheet steel. The cabs are so placed that there is room left between their sides and the edge of the car platform for carrying rails, poles or long timbers. In each of the cabs is a K-14 controller equipment, the locomotive being designed for double-end operation. Between the roofs of the two cabs is a bridge made of two 2x6-in. timbers laid flatwise and reinforced with 2½x2½x⅜-in. angle irons. On top of these timbers is a channel-iron runway which supports the movable trolley base. With this arrangement the trolley may be transferred from end to end of the car if it is desired to reverse the direction.

The steady growth of traffic on that division of the Michigan United Railways Co., which has headquarters at Lansing, Mich., recently made it necessary to provide additional facilities for the storage and repairing of the various types of city and interurban rolling stock. These increasing demands can now be well taken care of in a new group of buildings at Lansing, Mich.

The new buildings are conveniently located at but a short distance from the center of the city. The buildings include an office, shop and car house of three main parts, an adjacent brick warehouse and the recently equipped employes club house, a short distance away and on the same plat of ground.

The west division of the main building is two stories high at the front end and a single story high at the rear. The second story of the front portion of this bay is suitably equipped for the business offices of the company. Under the business offices on the first floor are the offices of the operating department. This portion of the building is so partitioned that separate rooms are provided for the superintendent, dispatcher, master mechanic and storekeeper. A large room has also been set apart for the use of the train men. Around the walls of this room are neat lockers of hard pine and across one end is a large "run" board. At the rear of the storekeeper's office is a stock room plentifully provided with storage facilities for all kinds of smaller materials. Opening from the storekeeper's office is a large fireproof vault in which the more

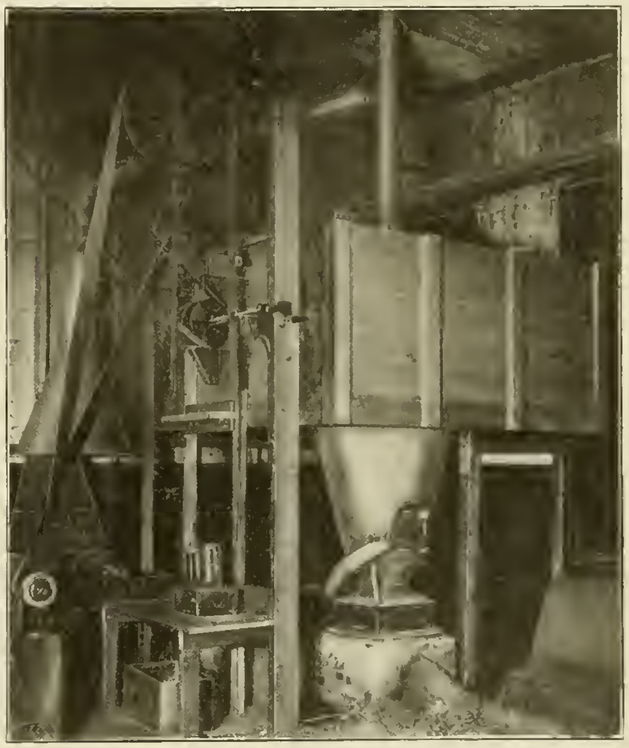


INTERIOR OF EMPLOYES' CLUB ROOM.

valuable materials are kept. This vault extends through the ceiling and has another entrance from the general offices on the second floor.

On the opposite side of the building from the store rooms and at the rear of the master mechanic's office is the armature room. Along the west side of this room is a work bench and at one end of the room is fitted a vertical rack arranged for holding a large number of armatures without encroaching on the floor space. At the opposite end of the room from the racks is a brick armature baking oven 8 x 8 x 6 ft. in size. This oven has double steel doors and is heated by a set of resistance coils arranged by the employes of the shop.

One of the interesting home-made devices in this department is a portable water resistance used for testing purposes. By reference to the accompanying illustration it will be noted that this water resistance consists of a small barrel or keg to the sides of which



HOME MADE SAND DRYING APPARATUS.

are fastened vertical 2 x 2-in. wooden posts. Near the top, these posts are pierced by a horizontal shaft fitted with a crank at one end. On this shaft is wound the rope which supports an old journal brass used for making electrical contact with the water in the barrel. By means of a flexible cable this piece of brass is electrically connected to a porcelain connection socket fastened to the framework holding the small windlass. A suitable plug with a flexible cable completes the circuit between the porcelain connection block and the source of current. The cable, from a plate immersed at the bottom of the inside of the barrel, is brought through a wooden bushing driven tightly into the bung hole. This cable is of sufficient length to connect with an ammeter or other instrument in the circuit with the coils to be tested.

At the rear of the armature and store rooms extending across the full width of this bay of the building, is the machine shop. The tools in this shop include a lathe, 34-in. shaper, drill press, emery wheel, power hack saw, wheel lathe and the 200-ton hydraulic wheel press. This wheel press is set in a pit, suitably depressed so that the 34-in. wheels on their own axles may be rolled into the press without the necessity of raising or lowering them.

Suspended from the ceiling of the shop is a system of overhead travelers which serves the repair and machine shops and the armature room. By means of chain blocks and air hoists hung from these travelers, armature and truck parts may be taken from the repair pits and easily removed to any desired part of the building. A part of the floor of the machine shop parallel with one of the side walls is set apart for storing various kinds and grades of car wheels. To separate the different classes of wheels a line of wooden posts, each about eight inches square, is arranged parallel with the building wall and far enough apart so that 10 or 12 wheels of a kind may be stacked against one of the posts. Over this line of posts and wheels is a branch of the traveler system which greatly facilitates the moving of wheels between different parts of the building.

At the rear of the machine shop is a blacksmith shop which also is the full width of this division of the building. In the blacksmith shop are forges, an emery wheel and a suitable equipment of tools for doing forge work on heavy truck parts. At one corner of the blacksmith shop adjacent to the partition wall separating this shop from the machine and repair shops, is the sand drying apparatus shown in the accompanying illustration. This useful apparatus, which is said to operate very satisfactorily, consists of a common type of stove mounted upon a suitable brick foundation. The stove has an especially large dome extending up through the center of a large sheet steel hopper. Over this hopper is a screen driven by a connecting rod from a nearby shaft. Around the screen and the hopper has been built a large box into which wet sand may be shoveled through a window affording an opening directly above a track in the next bay of the building. This box is sufficiently long to hold a plentiful amount of wet sand and also permit a man to stand inside and feed sand to the screen. As the sand passes through the screen it falls on top of the large dome of the stove, is dried and falls down to the bottom of the hopper, where it is collected by a suitable trough and passed through a chute into a storage box.

A line shaft 135 ft. long and driven by a Westinghouse No. 3 railway motor, serves to drive the various tools in the blacksmith, carpenter and machine shops.

The carpenter shop is immediately at the rear of the blacksmith shop and separated from it by a fireproof partition. This shop is equipped with band and jig-saws, planer and a steam box for drying lumber. Adjacent to the carpenter shop is a storage room for all kinds of hardwood lumber used in car repairing.

At the rear end of this portion of the building is a large room for stabling the linemen's emergency wagon and team. One corner of this room is enclosed as a storage room for linemen's tools.

The middle bay of the main building is used for general car repairing and painting. A partition wall divides the bay into two parts. Two tracks extend the entire length of this portion of the building, the forward part of which is the repair shop. Under the track nearer the machine shop is a concrete working pit of the usual dimensions. At the rear of this pit is a turntable connecting the pit track with rails leading into the machine shop.

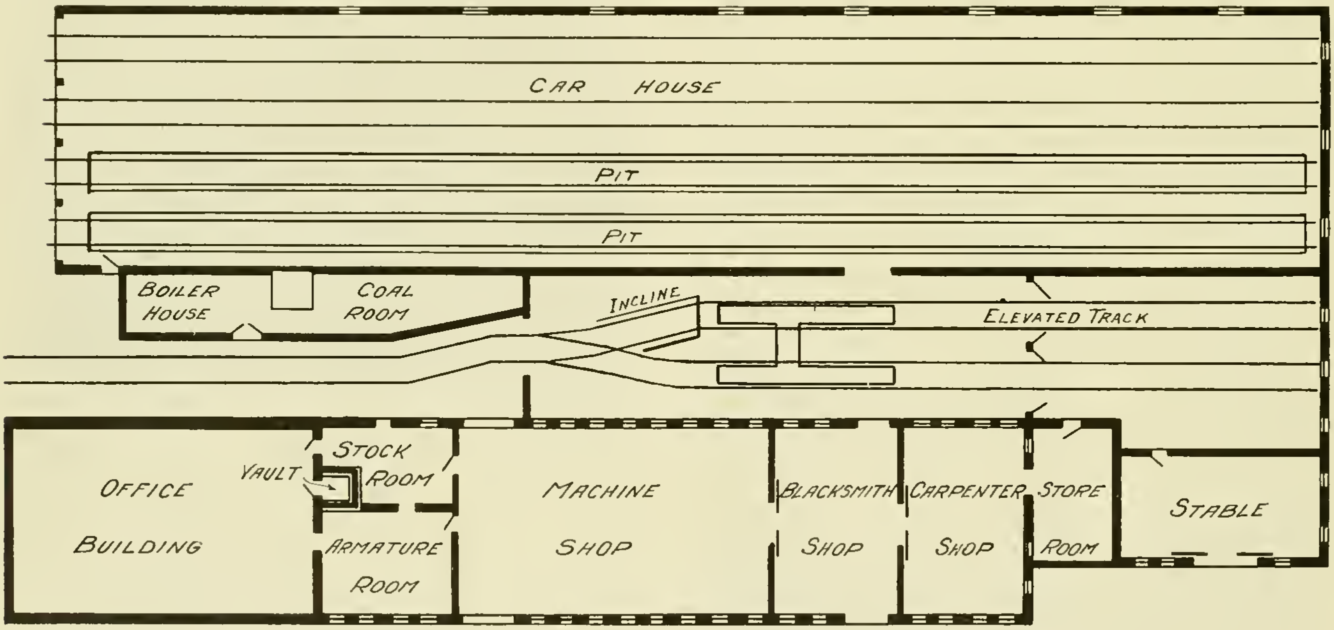
The east track is elevated above the general floor level for the entire length of the building. A short portion of the track just inside the entrance doors is laid in the form of an incline elevating the tops of the rails 14 in. above the general floor level. From the end of this incline to the rear of the building each rail is maintained at an elevation of 14 in. above the floor level by means of vertical cast-iron posts, to the tops of which they are secured with bolts. These posts supporting the rails are set 3 ft. 6 in. apart and extend into the concrete wall forming the sides of the pit under the track. The side walls of this pit are 18 in. thick, the pit is 3 ft. 10 in. wide and 3 ft. 6 in. deep below the floor level.

This method of supporting the repair tracks at some distance above the general floor level is found to have many advantages in the repair shop as well as in the paint shop. With the rails elevated and with no stringers supporting them the pit is plentifully supplied with natural light. There is also an opportunity for working on the lower outside parts of the trucks without necessitating a man lying flat upon the floor to reach the various parts. As this track is similarly elevated in the paint shop it affords the advantage here in striping or doing close work on the sides of the cars. Car panels are about breast high and can be worked upon without getting in a cramped position.

At one end of this repair pit is a wheel pit over which is a removable section of the track so that axles may be dropped into the pit and lifted out by the overhead traveler system. In the front of the repair portion of the barn and at a point near the center of the group of buildings is a boiler plant for heating purposes.

The largest division of the building is the storage house which is 250 ft. long and has four tracks. There are pits throughout the length of two of these tracks so that the light repairs and inspection work may be readily done. There are no posts in this building, but the roof is supported by steel trusses spanning the space between the side walls. A novel type of construction has been used for obtaining a slow burning roof over the storage house. Instead of using the ordinary method of planking, 2 x 4-in. pine scantling standing on edge span the distance between the different trusses and as they are nailed tightly together, afford a smooth upper surface for the fire-proof sheet roofing. Adjacent to the east side of the storage building is a large warehouse where accommodation is provided for all classes of large grading and other tools and raw materials.

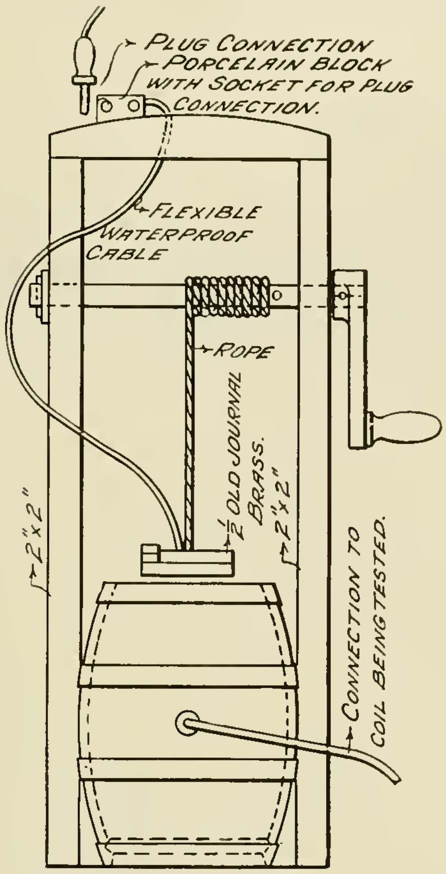
At the northeast corner of the property a one-story frame building about 40 x 75 ft. in floor area has been fitted up by the management of the railway company and donated for the use of the Lansing & Suburban Social Club. The membership of this club is made up of various employes of the Lansing & Suburban Traction Co., who pay one dollar each for initiation and monthly dues of 25 cents each. In the building are a reading room, cigar stand, barber shop and billiard tables. These nicely furnished rooms are kept in neat condition by those of the employes who may for any reason be in such pyhsical condition that they cannot do their regular work on the road, but are able to be about the club rooms. A charge of one cent per cue is made for playing pool or billiards.



PLAN OF CAR HOUSE AND SHOPS OF THE LANSING & SUBURBAN DIVISION OF THE MICHIGAN UNITED RYS.

Power Supply.

The power for the operation of the entire system of the Michigan United Railways Co. is purchased on a kilowatt-hour basis from the Commonwealth Electric Power Co., of Jackson, Mich. This company owns several water-power generating plants located near the interurban line and between Allegan and Jackson. The general arrangement of the transmission lines and the location of the various sub-stations may be learned by reference to the accompanying map. It will be noted that at the larger cities there are steam reserve plants which may be called into service should the water-power station for any reason fail.



A SIMPLE HOME-MADE WATER RESISTANCE.

Improvements at Clinton, Ia.

The reconstruction of the properties of the State Electric Co. in Clinton, Ia., which has been in progress for the past two years, has placed this road in a condition which compares favorably with that of other systems serving a population of 30,000.

During this period a large part of the 14 miles of track has been relaid, the number of cars has been increased from 8 to 20, and new car barns have been built. Ten cars are now operated regularly, while ten are kept in reserve for periods of heavy traffic.

The car barns, located on Second St., are very conveniently arranged. The ground-plan is in the shape of an L 177 ft. long and 100 ft. wide. The shops are 140 ft. long and the general offices and employes' room occupy the short arm of the L. The building is constructed of sand-lime brick and has concrete floors throughout. Three fireproof brick walls lengthwise of the building divide it into four separate sections, two of which are used for car storage purposes, one for repair work and the fourth for offices, storeroom and machine shops. The roof of each section is built independent of the others, so that a fire in one section cannot spread to other parts of the building, and the timbers supporting the roof are not heavy enough to destroy the walls in case of a collapse caused by fire.

The new building is heated by a hot-air furnace located in a rear room.

Offices of Schoepf Syndicate to Move to Lima.

Announcement has been made that the general offices of the interurban lines belonging to the Schoepf syndicate will be moved in the near future from Cincinnati to Lima, O. It is stated that it is the intention of the company to erect an office building to cost thirty or forty thousand dollars at the corner of Main St. and Grand Ave., on a plot of ground purchased some time ago, and that the work will be begun at once and rushed to completion.

A Third Interurban Line Between Minneapolis and St. Paul.

On May 21st the Twin City Rapid Transit Co. began operating cars over a third interurban line between Minneapolis and St. Paul which penetrates the most desirable sections of both cities.

The line, which is practically 13 miles long, will be known as the "Selby Ave.-Lake St." interurban. It runs from Hennepin Ave. and Fifth St., Minneapolis, out Hennepin Ave., to Lake St., thence across Lake St. and the Mississippi River to Marshall Ave., Fairview Ave., Selby Ave. and Fourth St. to Broadway in St. Paul. With the exception of two short blocks on Fairview Ave. it is practically straight from Hennepin Ave. and Lake St., Minneapolis, to the beginning of Fourth St. in St. Paul.

The Lake St. line from Hennepin Ave. to the river was opened last year and a short stretch of track on Marshall Ave., in St. Paul, was built to the river. As soon as the new bridge across the river was built, the two lines were joined. The line will open up a considerable section of the country between the two cities and it is expected that it will greatly benefit Merriam Park, a beautiful new suburb in the western part of St. Paul.

For this line a special equipment was needed because in St. Paul the line follows the steep Selby Hill, which is a 16 per cent grade. To operate cars over this hill, an equalizing device with a counterweight system is used. Special brake rigging is necessary in order to get the proper clearance.

The cars used on this line are 47 ft. long, 9 ft. 8 in. wide, and seat 52 passengers. They are roomy and comfortable and are the product of the company's own shop.

May Meeting of the New England Street Railway Club.

The last meeting of the New England Street Railway Club before the fall was held at the American House, Boston, on the evening of May 24th, President Winsor being in the chair. It was announced that an excursion of the club would be held in June, probably to the works of the Fore River Ship and Engine Co. and the Quincy Point power station of the Old Colony Street Railway Co. at Quincy, Mass., followed in the afternoon of the same day by a trip to Nahant. The plan is to charter a steamer and make the affair an all-day outing by water.

President Winsor also stated that a street railway information bureau is to be established in Boston under the auspices of the club during June, July and August, in the offices of Messrs. Raymond and Whitcomb, the well known excursion agents. Mr. M. L. Wood will be in charge, and it is planned to make the bureau a live center of information for New England tourists. The location of these offices on Washington St. will render it possible to do more effective work in the way of street railway advertising than has heretofore been feasible. Several of the New England street railway companies have entered heartily into the support of the plan, and others are expected to follow. The offices will be provided with telephone service and all the folders, booklets and timetables of the various street railway companies.

After the election of several new members, the usual paper was presented, the speaker being Geo. W. Knowlton, of Boston. The subject of discussion was "Rubber: Its Growth, Treatment and Uses." Mr. Knowlton illustrated his paper by a large collection of lantern slides, and showed samples of rubber from different parts of the world. He spoke briefly upon its insulating value, and criticised the tendency of engineers to draw too rigid specifications for rubber in comparison with iron and steel specifications. About 100,000,000 lbs. of rubber are now produced yearly. The cost per pound is about $1.35, so great is the demand for it for industrial and domestic purposes, in comparison with 65 cents per pound a few years ago. It is doubtful if the price goes below one dollar per pound in the future. No efficient substitute for rubber has yet been found. A brief discussion followed the reading of the paper.

New Interurban Equipment for the Detroit United Railway.

Ten interurban cars of interesting design are just being put into service on the several interurban lines of the Detroit United Ry. An idea of the general appearance of this new equipment may be had by reference to the accompanying exterior and interior illustrations. In designing these cars it was desired to assure the construction of a substantial, durable and comfortable car without any "frills" or artistic decorations. The preliminary designs for the new cars were prepared under the supervision of the operating officials of the Detroit United Ry.

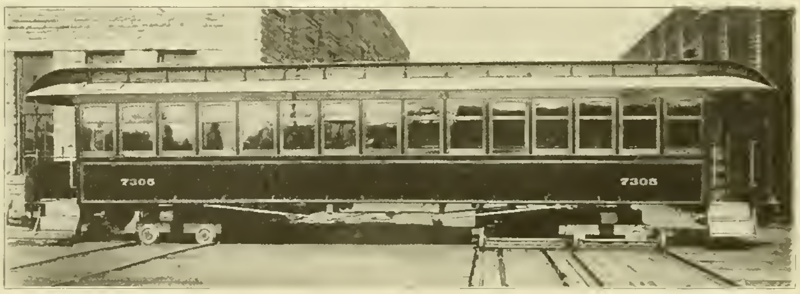
Each of the new cars is 52 ft. 6 in. long designed for single-end operation and has two passenger compartments, one of which is set apart for smokers. The interiors of the compartments and vestibules are finished in natural cherry. At the rear of the main compartment is a toilet room and immediately in front of this is a small compartment with a door opening into the aisle. A hot-water heater is installed in this compartment and the partition walls are insulated from the heat of the stove by a layer of asbestos supported by a protecting covering of sheet zinc. The usual arrangement of heating coils is installed in the body of the car and additional coils are placed on the front platform and in the toilet room. There is no space arranged for the handling of baggage as it is the policy of the Detroit United Ry. to operate separate baggage cars rather than handle such matter on regular passenger trains.

Tht front platform is entirely enclosed except for a door on the right-hand side. Large windows are permanently set in the framework of the front vestibule which, with the large windows between the main compartment and the vestibule, permit passengers to have an unobstructed view ahead of the car. The rear platform has a hood of the steam-coach type. The platform floor, which is of generous dimensions, is laid with narrow flooring so placed that there are cracks about one-eighth of an inch wide between the boards. These openings are left in the floor for the purpose of affording a quick drainage in time of wet weather. The rear platform is not enclosed except by the usual type of dashboard. The steps on the left side of the rear platform are protected by a safety gate that may be securely fastened when operating on double track. From the rear platform entrance to the body of the car is gained through a 36-in. door with its right post set 19 in. from the outside of the car body.

INTERIOR OF THE NEW DETROIT CAR.

The seats in the passenger compartment are of the Hale & Kilbourn steam railway coach pattern with high backs. These seats are 37½ in. long from the wall to the face of the end-plate. In the main compartment the seats are upholstered in green pattern plush and in the smoking compartment they are covered with leather. The aisle between the end plates of the seats is 20 in. wide.

The windows raise into the roof and the various dimensions were so adjusted that neither the lower sash of the upper window nor the lower sash of the lower window when it is raised, will obstruct the view of a seated passenger. The window openings are 21 in. wide and the distance from the car seat to the lower sash of an open window is about 34 in. Storm windows which may be fastened to suitable sockets are available for winter use. There are wall sockets placed between the various pairs of seats so that tables can be used if desired. In the vertical post opposite each seat and on the platforms are push-buttons for signaling the crew. Match scratchers are provided in the smoking compartment and over the end seats in this compartment are signs requesting the passengers to keep their feet off the seats. The ceiling of the car body and vestibules is painted a nile green and from it hang 35 incandescent lamps grouped in seven clusters, which arrangement furnishes a generous illumination. The window curtains are of "Pantasote" and there are ventilator rods for hand operation, and liberal parcel racks.



ONE OF THE TEN NEW CARS OF THE DETROIT UNITED RY.

The car bodies are mounted on Baldwin M. C. B. trucks with steel-tired wheels. Each car is equipped with four Westinghouse No. 112 motors which are rated at 75-h. p. capacity, and Westinghouse pneumatic, multiple-unit switch control for train operation. The power brakes are operated by storage air and "Peacock" hand brakes are used. The Detroit United standard type of drop fender is used. Some of the other fittings of the car include a trolley retriever and an extra trolley pole secured to the roof the car, rear-end electric markers with six-inch lenses, destination signs on the right-hand front and rear dashboards, standard steam railroad oil-light markers, two for the front end and one for the rear and a fare register. This interesting new equipment was built by the Cincinnati Car Co.

New Elevated Road in New York.

It has been announced that a company has been organized to build a six-track elevated railroad on the East Side. This new organization will be known as the East Side Viaduct Railroad Co. The line is planned to extend from the Bronx side of the Harlem River to 34th St., making connections at 42d St. with the Interborough line running to the Grand Central station, and at its 34th St. terminal with lines running to the Battery and the Long Island R. R. ferry. It is understood that the scheme is planned to bring the New York, New Haven & Hartford R. R. into the heart of the city from its present terminal in the Bronx.

The Philadelphia, Lancaster & Harrisburg Railway Co. has recently contracted with the York Haven Power Co., for the necessary current to operate its electric railway system. A cable line will be laid across the river at York, Pa., to be completed with a substation which is now being constructed on the Lancaster County side of the river. In addition to this, the York Haven Power Co. will furnish power for operating the York Street Railway Co's. lines, as well as numerous industries in the vicinity.

Personal.

MR. T. B. REDMOND has resigned as general manager and purchasing agent of the Mississippi Valley Traction Co.

MR. CHAS. BLAKELY has been promoted to the position of superintendent of transportation of the Chicago City Railway Co's. lines, with offices at 2020 State St.

MR. ROBERT GRINNELL has been appointed superintendent of employment of the Chicago City Railway Co.'s lines. Mr. Grinnell will continue to make his headquarters at 2020 State St.

MR. J. W. LEADLEY, recently superintendent of roadway for the Savannah (Ga.) Electric Co., has been appointed general manager of the Pensacola Electric Co., which has recently been purchased by Stone & Webster of Boston.

MR. L. O. WILLIAMS, who has been superintendent of the division of the Illinois Traction System between Springfield and St. Louis, has been placed in charge of the Illinois Central Traction Co's. lines between Springfield and Decatur.

MR. A. GABOURY has been made assistant superintendent of the Montreal Street Ry. at Montreal, Canada. Mr. Gaboury has been in the employ of the company since 1892 and until his present promotion held the position of claim agent for the company.

MR. C. M. GRAVES has been appointed general manager of the Spokane Traction Co., taking the place of Mr. B. J. Weeks, who recently resigned. Mr. J. P. Ingersoll has been chosen assistant general manager and chief electrical and construction engineer.

MR. W. W. WATERSON, recently superintendent of terminals of the Illinois Traction System at Springfield, Ill., has been appointed superintendent of transportation for the St. Louis & Springfield and the Springfield & Northeastern railways, with offices at Staunton, Ill.

MR. M. L. HARRY, who has been general superintendent of the Decatur Street Railway & Light Co. and the Illinois Central Traction Co., has been promoted to take charge of not only these properties, but also the Springfield & St. Louis and the Springfield & Northeastern railways.

MR. EDWARD J. DAVIS, who has been connected with the Columbus, Buckeye Lake & Newark Traction Co. as excursion agent, has been appointed assistant traffic manager of the Columbus, Delaware & Marion Electric Railway Co., with office at Columbus, O., effective on June 1. He will be associated with Mr. A. L. Neereamer, traffic manager.

MR. WALDO G. PAINE, heretofore traffic manager of the Coeur d'Alene & Spokane Railway Co., has been appointed general passenger agent of the Inland-Empire Railway Co., with offices at Spokane, Wash. Mr. J. H. Lothrup has been appointed general freight agent of the Inland-Empire, with offices at Spokane, Wash.

MR. OREN ROOT, JR., was elected vice-president of the Metropolitan Street Railway Co. at a recent meeting of the board of directors. Mr. Root has been in the employ of the company for 11 years and has risen to his present position by reason of his conscientious and effective work in a number of the departments of the company.

MR. GEORGE P. DOLE, recently superintendent of the Providence & Fall River Railway Co., has been appointed superintendent of the New Bedford & Onset and the Taunton & Buzzard's Bay street railway companies, with offices at New Bedford, Mass. This appointment is the result of the consolidation of the two roads which involves some 60 miles of line.

DR. W. K. HATT has been appointed professor of civil engineering at Purdue University, succeeding Professor W. D. Pence, resigned. Dr. Hatt's appointment will be effective September 1st next. He has been identified with Purdue University since 1893. He graduated from the University of New Brunswick in 1887 and from the college of civil engineering of Cornell University in 1891. Dr. Hatt has had a varied experience in the practice of civil engineering along different lines, particularly in railroad location, construction and maintenance. In order that the Purdue laboratory for testing materials, of which Dr. Hatt has had charge, may continue to have the benefit of his direction, its organization is to be incorporated with that of the schools of civil engineering. He will also continue to act as consulting engineer for the Forest Service of the United States Department of Agriculture.

MR. GEORGE M. COLE has resigned as general manager of the Oneonta, Cooperstown & Richfield Springs Railway Co., by reason of the change in ownership of this property. Mr. Cole has been general manager of the road since December, 1902. He has proven himself to be a successful manager and has won the confidence of all with whom he has been associated.

MR. DAVID YOUNG, JR., who has assumed charge of all the electric railway lines of the city of York and York county, Pa., in the capacity of general manager of the York County Traction Co., the York Street Railway Co. and allied corporations, is one of the youngest street railway managers in the United States, being but 25 years old. Mr. Young was born in Newark, N. J., and entered the service of the North Jersey Street Railway Co. immediately upon his graduation from the Newark Academy. While with this company he learned the practical details of street railway operation in the various departments, including the power house, repair shops, line and track department and the operating department. He then became manager of the Orange Mountain Traction Co. and at the same time assumed the management of the Peerless Electric Co., of New York City. In 1904 Mr. Young went to San Francisco, where he assumed the position of superintendent of the United Railroads. His supervision extended over all the electric lines north of Market St. Just prior to the recent disaster in San Francisco, Mr. Young resigned the superintendency to accept his present position. The results following the earthquake detained him in San Francisco, where he remained with the United Railroads until its lines were again in operation. Mr. Young has succeeded A. H. Hayward, who was formerly general manager of the York Electric Railway Co. Mr. Hayward has been elected vice-president of the reorganized board of officers and directors of the York County Traction Co. and the York Street Railway Co. In addition to performing the duties of vice-president Mr. Hayward will superintend the construction of interurban and suburban electric railway lines which will be added to the system during the summer.

DAVID YOUNG, JR.

MR. F. T. HEPBURN of Altoona, Pa., who on May 1st was made general manager of the Schoepf traction properties at Lima, O., has assumed jurisdiction over the recently purchased Columbus & Lake Michigan steam road, the Ft. Wayne, Van Wert & Lima Traction Co. to the Ohio-Indiana state line as well as the city properties. Mr. Hepburn succeeds Mr. J. A. Bendure.

MR. FRANK A. BURKHARDT, who has been connected for several years with the passenger department of the Cincinnati, Hamilton & Dayton Railway Co., has been appointed district passenger and freight agent for the Schoepf syndicate, with jurisdiction over the Lima & Toledo, the Fort Wayne, Van Wert & Lima, and the Columbus & Lake Michigan lines. Mr. Burkhardt's headquarters will be at Lima, O.

MR. E. P. DOYLE has succeeded Mr. D. D. Miles as master mechanic of the Aurora, Elgin & Chicago Railway Co. at Wheaton, Ill. For the past three years Mr. Doyle has been in the employ of the Illinois Traction Co. and for a number of years prior to that time was associated with the Metropolitan West Side Elevated Railway Co. in Chicago. He assumed his new duties on May 1st.

MR. JOHN M. BRAMLETTE, recently general manager of the Philadelphia & Western Railroad Co., has resigned his position with that company to become general superintendent of the Michigan United Railways Co., with offices at both Lansing and Kalamazoo, Mich. Mr. Bramlette was for 10 years general manager of the East St. Louis Railway Co., of East St. Louis, Ill. For the past year he has been engaged in directing the construction of that part of the line of the Philadelphia & Western from 63d and Market St. to Wayne, Pa., which is about one-third of the entire system that will shortly be put in operation. The Michigan United Railways Co. controls all of the street railways in Lansing, Battle Creek, Kalamzoo and Jackson and something over 100 miles of interurban track. In all about 200 miles of track are operated and there are numerous additional lines contemplated, many of which are now under construction.

Insulating Varnish for Armature Coils.

BY ARTHUR B. WEEKS.

One good method used by many repair men in the application of insulating varnish to field and armature coils is to wind them dry, dip them in varnish, then after hanging over a vat and allowing them to drip a sufficient length of time, to place them in an air-oven and thoroughly bake.

Another method of applying the varnish to the wire before winding has also given satisfaction. In this process, the wire, just before it is wound on the coil, is passed through a vat of varnish, being led over and under several sheaves which keep it in tension. It is necessary that these sheaves run quite true, be free from burrs, and that the operator be cautious in adjusting the tension so that any cutting of the insulation may be prevented. This method of winding and insulating coils is more rapid than the hand application methods because when using the varnished wire it is not necessary to stop the winding lathe and apply the varnish to each layer as it is wound. Another advantage is, that the proper amount of varnish is applied; and so no time is lost during the dripping process, and the coil can therefore be placed in the baking oven as soon as the binding is adjusted. This method of winding not only saves varnish but furnishes better results than the slower methods because coils, which contain an excess of varnish, cannot receive enough heat in the baking process to dry out properly, and if not thoroughly dry corrosion with almost all varnishes is very liable to occur within a short time.

The electro-drying method affords a very thorough and rapid method of drying field and armature coils. With this method it is just as convenient and takes no more time or current to dry several coils in series than it does to dry one. The writer has seen instances where dipped and oven baked varnished coils began to show indications of verdigris within 30 days after baking. As a remedy for this trouble he dried the coils by passing a sufficient current through them to heat their interior to perhaps 190° F. After this drying the green cast of the cotton insulation soon disappeared and in no case did the familiar green appear on electro-dried coils.

To electro-dry several coils at one time it is necessary to arrange a rack supplied with a row of wooden pegs upon which the series of coils may be hung and some scheme for quickly joining the ends of the coils. During the electro-drying process the operator must keep watch of the amount of current flowing and not allow the insulation to overheat.

It is more of a trick to fasten band wires on an armature than the casual observer would suppose. If the binding is not put on thoroughly the wires will become loose after the armature has been in use but a short time, and on street railway motor armatures for example, a loose wire coming in contact with the commutator or brush holders and the frame-work will cause the fuses to blow. When such a defective motor is cut out and inspected the cause of the trouble is easily located.

If the repair shop does not contain the necessary power driven apparatus for winding coils, a device which will do satisfactory winding and binding can be quickly and inexpensively constructed.

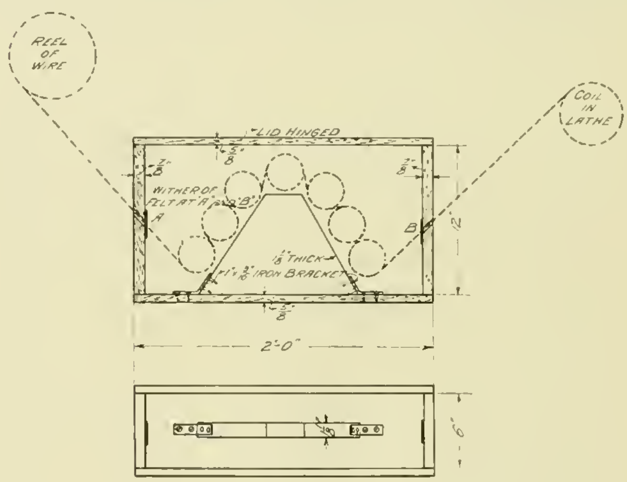
The difficulty in putting on band wires is most often due to a sloping surface like that at the pinion end of a G. E.-800 armature. Many armatures require a second band below the first; in this case a strip of sheet copper or steel which has previously been placed under the first wound band is extended down as far as required and turned up at the lower end. The binding wire after first having been made fast to one of the lugs by soldering or by some other method, is then carried down to the bend in the binding strips. When enough wire has been wound on, the free ends of the copper strips are turned back on the several binding wires and soldered. Use no more solder than is absolutely necessary. Strange as it may seem, many electricians have much to learn about this line of work. Some use too much insulation under the binding wires or fail to draw the coils far enough down in their slots or misplace the insulating material so that it is drawn under the coils when they are inserted in their slots. Before binding an armature it should be revolved and careful note be taken that the coils are all rightly placed. The usual clearance between armature fields, is so small that any irregularity in the armature will soon manifest itself by rubbing on the pole faces.

When large armatures are to be repaired on the premises some powerful method is necessary for winding band wires. One way is to place the armature shaft on Vs, make the blocking secure to prevent pulling away and upsetting the armature, then pass a rope several times around the armature and tie the free end of this rope to the hook of a block and tackle. In binding an armature by this method it is necessary to keep the binding wire under heavy tension. When arrangements for doing this are provided and the wire securely fastened, the armature can be revolved by pulling upon the tackle rope and the tension thus maintained.

A winch could be used in place of the block and tackle if found more handy.

After winding an armature in this manner it should be given a coat of finishing varnish. It was once customary to use shellac for this coating, but now some companies make special baking and air drying varnishes for finishing armatures. These coatings should be both oil and water proof.

A special black insulating varnish which does not require baking is now much used. This varnish has the advantage that it will not become brittle and therefore will not injure neighboring coils if repairs are being made, which is a valuable characteristic



VAT FOR APPLYING INSULATING VARNISH.

when it is understood that many burned out coils must frequently be removed and replaced. This insulating varnish has characteristics entirely different from the finishing varnish mentioned earlier in this article, in fact it is not ordinarily used as a finishing varnish except in local street railway shops which do their own repair work; yet as a finishing varnish it will prove very satisfactory because the parts can be wiped off with oily waste and the surface not injured. This black insulating varnish may be used on field coils as well as armature coils and in many cases is preferable to clear insulating varnish.

The materials which are used in these processes of insulating, winding and binding, such as linen, tape, duck and muslin should be treated with clear insulating varnish when they are used.

The chief requirement for insulating varnish is elasticity, one test for which is as follows: Dip a bit of flexible copper into the varnish and allow it to air-dry and if the varnish is of the proper sort a film turned up by a knife blade drawn across the test piece should be elastic even after several months' drying, and the bending of the copper should not crack the varnish.

A similar test may be performed by dipping pieces of bond paper in the varnish and allowing them to air dry. After drying for some time the varnish should not become brittle nor break when the paper is bent.

off a revolving armature when the machine gets up to speed and working temperature. This should be avoided in every instance and nothing but materials guaranteed suitable for the purpose should be used.

The Cleveland Electric Railway Co. has recently received from the officers of the Columbian Exposition at St. Louis, the diploma and bronze medal awarded last year for work done along the line of the industrial betterment of its employes.

Improvements by the Public Service Corporation of New Jersey

Since the Camden & Suburban (84.65 miles) and the Camden, Gloucester & Woodbury (21.48 miles) three years ago were leased to the Public Service Corporation of New Jersey and consolidated as the South Jersey Division of that company's electric railway system, H. A. Johnson, chief engineer of the division, has been engaged in working out a policy of improvement, unification and standardization for the properties.

Besides serving very thoroughly the city of Camden, N. J., the South Jersey Division has branches extending from Camden to North Cramer Hill, to Riverton, on the line to Trenton and New York, to Moorestown, to Haddonfield, to Clementon, to Mantua, to Blackwood, to National Park.

During Mr. Johnson's administration the growth of traffic has necessitated four additions to the present barn, repair shops and power plants, and the decision has now been reached to spend several hundred thousand dollars in the erection of shops which will have facilities for handling 52 cars per day in regular maintenance and which will be equipped to enable the company to build its own cars at a saving, in competition with established builders. The shops will be centrally located on the division, on the outskirts of Camden, and will occupy a plot of 8 to 10 acres in extent. Pending the building of the shops, labor saving machinery is being installed in the present shops. Compressed air is being used extensively. By the use of pneumatic tools it is expected to reduce the shop maintenance cost, which is 1.6 cents per car mile, to 1 cent per car mile.

Since the acquisition of the properties by the Public Service Corporation, a great portion of the trackage has been completely relaid with 90-lb. girder rails. During the past year 25 miles of track have been electrically welded. Money is being systematically expended to secure loops at all terminal points and schedules are being arranged to obviate the necessity of layovers at terminals. Four extensions recently have been made to the central power station, which is located on the banks of a creek where the water supply is good. Extensive additions have been made to the equipment of this station. In order to rival the service of steam roads, which the lines parallel, and to keep abreast of the equipping of the West Jersey & Seashore for electrical operation, all of the company's old equipment is being gradually disposed of with a view to adopting as permanent standards three types of cars suitable to the varied demands upon the service. From $300,000 to $500,000 already has been expended in pursuit of this policy and other expenditures will be authorized. The first type will be a small single-truck car, with a 21-ft. body, exclusively for local service in city territory. The street crossings in Camden are rather close together, some of them not over 300 ft. apart, and the short car, equipped with No. 101 B Westinghouse motors, has been deemed best suited to this service.

The second type of car is that intended for suburban service. This will be of the Brill semi-convertible type, with a car body 33 ft. 6 in. long and equipped with Westinghouse No. 93 motors and Baldwin trucks. These cars are expected to maintain a schedule of 30 miles per hour.

The third type of car will be adapted for service in the long runs, as between Camden and Burlington, 25 miles, and Camden and Clementon, a like distance. These cars will have 50-ft. bodies and will be mounted on Baldwin high speed trucks equipped with Westinghouse No. 112 motors.

All cars are equipped with vestibules and all future cars are to be closed or of the semi-convertible type. The few open cars now in service will be maintained, but no others of this kind will be built or purchased. The Baldwin trucks equipped with steel-tired wheels are being adopted as standard for all cars. Motors are of the latest Westinghouse make, the type being the same for all cars but of different horsepowers. All underhung drawbars are being eliminated in car construction, the cars being provided with a rigid drawhead on the platform crosspiece, which in turn is tied through the center of the car. Particular attention is being given to the introduction of rigid underframing throughout. Outside builders are required to build to the specifications of the company. It has been decided to discard the stoves now used for heating and to equip cars with hot water heating systems, the water to be boiled by gas. The corporation controls the gas, electric and water plants of a number of towns and the gas and electric plant of Camden, and is therefore in a position to establish this heating system upon an economical basis.

The total number of cars now in service over the division is 152, of which 73 are open cars and 79 closed cars. There are now on order with the J. G. Brill Company 33 suburban cars. Eight cars are being built in the company's own shops for local service and eight high speed cars for long distance service. The service offered by the company has a number of interesting features. Among these is a special club car service. In this service a number of suburban cars are chartered by the Moorestown Rapid Transit Club, an organization of business men, and are run without stop to their destination. The club is thus able to offer its members better service than they would otherwise obtain. The Corporation also does a large special car business. The fact that the company can offer a six-hour run without covering the same track twice has encouraged the use of special cars by trolley parties, and the fact that the system serves a great many small towns which are six or eight miles apart, and that it reaches a number of parks, brings the special car into demand for various outing purposes and on public occasions. The lines of the division pass a number of cemeteries and this has led to the very frequent use of the special car equipped for funeral purposes. The company's rate for the charter of this car is $25.

The car or coach building activities of the corporation are forecasted by an inspection of one of the 50-ft. cars just completed in the present shops for high speed suburban service. These cars are equipped with an enclosed smoking room at one end similar to those to be found in steam railway coaches. The car has seats for the accommodation of 35 persons. The floor is entirely without traps and has a permanent rubber-cork covering. The finish is cherry throughout. Careful attention has been given to lighting and an electric bulb is installed over every seat. An improved center rod ringing device has been installed, with one register for cash and the other for tickets. The cash bell has a high tone and the ticket bell a low tone, an arrangement which makes it possible for an inspector to keep a careful account of the fares and tickets that are being registered. The car is strongly built and is intended to rival steam road service. It was designed by H. A. Johnson and built in the shops under his supervision.

The cost of track construction and maintenance on the system has been reduced 25 or 30 per cent by the use of a large crane of 20-ton power. This crane is found to lessen greatly the labor in removing frogs and replacing them with new ones. In view of the great number of steam crossings on the division and the consequently heavy repairs that have to be done, the saving of time by the use of power has been an important consideration. For maintenance work the company also has an electric locomotive, an advertising car and a number of flat and wreck cars. The reconstruction and maintenance by these improved methods have been under the direct charge of H. A. Johnson as a feature of his efforts toward the standardization of the property.

Construction Work on the Danville & Eastern Traction Co.

A meeting of the stockholders of the Danville & Eastern Traction Co. was recently held for the purpose of completing arrangements for the construction of the road. The road is to use the terminal of the Illinois Traction Co. for its entrance into Danville, Ill., and the latter company is to extend its Main St. line to Brewer where it will connect with the line of the Danville & Eastern Traction Co. to Crawfordsville and Indianapolis. From Brewer the route will run direct to Covington and from there to Stone Bluff and Crawfordsville to Indianapolis. Practically all of the right of way has been secured and the grading has been completed between Crawfordsville and Indianapolis.

The New York, New Haven & Hartford R. R. will begin work in the near future on an electric line about 10 miles in length from Bennington, Vt., to the Massachusetts state line.

A new interurban union station has been opened in Detroit and will be used by all lines entering the city. The waiting room, ticket offices, restaurant and other features of a well equipped union passenger station will be located in the Mabury Bldg., a seven-story brick block at the corner of Griswold and Larned Sts.

The Street Railway System of Lucerne, Switzerland.

BY FRANZ KOESTER.

The town of Lucerne, on account of its advantageous situation on the banks of the Reuss and the Quatre Cantons lake, contains, in addition to its resident population, a large and cosmopolitan transient population, composed of strangers and tourists who come to pass the summer. From the center of the town, four long avenues radiate toward the north, east, south and northwest. Realizing the advantages which would accrue from a well laid out tramway system, the municipal council of Lucerne asked for a street railway concession from the Federal council, and received the necessary grant.

In order to insure efficient communication between the different parts of the town and the central square, four principal lines have been built. The termini of these lines are the Maienhof on the north, the Hotel Europe on the east, the Kriensergatter on the south, and the Reussinsel or the Krugstutz on the northwest. Two of these lines join other lines going into the country, namely, the line from Kriens which connects the industrial part of Kriens with Lucerne and the line from Krenzstutz Emmenbruecke.

Power Station.

The power station is built of brick. It includes a main building in which are the machines and the auxiliary apparatus and an annex which contains the storage batteries. The main building contains the engine room which covers an area of 1,200 sq. ft., the machine room, 192 sq. ft., and the superintendent's office, 139 sq. ft. The engine room is spanned by a three-ton traveling crane and is

STANDARD CAR IN A VERY NARROW STREET.

lighted by three large windows in the side wall. In this room are two groups of rotary converters, each of which is composed of a 150-h. p. synchronous motor, direct connected to a continuous current generator. The energy necessary for the operation of these groups is transmitted from the power house at Rathausen as two-phase current at 3,200 volts and 40 cycles, which pressure is later transformed to 2,300 volts. A special coupling arrangement provides for the connecting of the generators to gas engines in case of the failure of the current supply. In addition to this equipment, it is proposed to construct a new power house so that later the current from Rathausen will serve only as a reserve.

The two-phase motors of the motor-generator sets are of the 10-pole type and operate at a speed of 470 r. p. m. The continuous current generators, which are of the Oerlikon type, have a gen-

VIEW SHOWING GUARD FOR TELEPHONE WIRE.

erating capacity of 174 amperes at 575 volts pressure. The diameter of the direct-current armature is 29 in. It contains 200 slots in each of which are two copper conductors. The commutator is composed of 200 bars of copper, insulated between themselves by strips of mica. The diameter of the pole bore is 30 in., the excitation being produced by means of six bobbins connected in series each of which has 2,420 turns of wire. Four carbon brushes are mounted on each of six bar collectors corresponding to the six poles.

In order that the attendants cannot mistake the high-tension conductors for those carrying continuous current, the high-tension apparatus is kept well out of reach and is placed in a cellar under the machine room, where the different parts are carefully fixed upon porcelain insulators which are themselves mounted on iron framework. The commutators and resistances can be operated from the engine room by means of levers fixed to operating columns which also carry the apparatus for measuring the high-tension current. The conductors to the apparatus are carefully insulated and placed in the interior of the columns. The chamber containing all the apparatus necessary for the continuous current is separated from the machine room by the distribution switchboard which is composed of marble panels mounted upon an iron framework. The board carries the necessary measuring apparatus for each generator for the storage battery and the distribution system. The auxiliary equipment of each generator includes a switch, two fuses, an ammeter, a voltmeter and a pressure regulator. The storage battery equipment includes an ammeter, which also indicates the direction of the current, a voltmeter, a switch with fuse, a regulator and two

switches which permit of dividing the battery into two parts. For each of the three distribution lines, there is provided a group of apparatus consisting of an automatic overload switch, an ammeter and a lightning arrester with a magnetic blow-out. For controlling the current output of the battery, there is a recording ammeter. There is also a meter for measuring the total current.

The storage battery is composed of 270 Tudor elements having a capacity of 198 ampere hours. The elements are insulated from the ground by glass feet and are placed upon a wooden platform. The lighting of the different portions of the station is accomplished by means of incandescent lamps.

Routes.

There are two main lines which unite at their western terminus and are laid out so that every quarter of the town is well connected with the center. In order to provide for the numerous carriages which traverse the streets near the station of the Gothard railroad, the two tracks have been built on opposite sides of a very wide roadway. For the track between Lucerne and Kriens, the roadbed of an old steam road was utilized. As this road had been built to a wide gage, the track was utilized by placing between the two existing rails, a third rail, one meter from one of the old rails.

The track on the Maienhofstrasse and Baselstrasse has heavy grades and passes between the canton library and the "Wilder Mann" through a width of but 19 ft. and under a low bridge of the northeast Swiss railroad. This bridge is so low that during the passage of a car the trolley is almost horizontal. At the crossing of the street railway track with that of the Jura Simplon railway, automatic signals indicate the right of way. The length of this line is 5.37 miles, the Haldenstrasse-Kriens line being 3.15 miles long and the Maienhof-Krienzstutz line 22 miles long. When the construction of the Emmenbruecke line is finished, the total length of city lines will be 6.69 miles. Comparatively speaking, the profile of the roadway is favorable. The steepest grade is 4.5 per cent for a length of 984 ft. Upon the line to Kriens, the heaviest grade is 3.3 per cent and upon that to Emmenbruecke, 4.7 per cent.

Roadbed and Track.

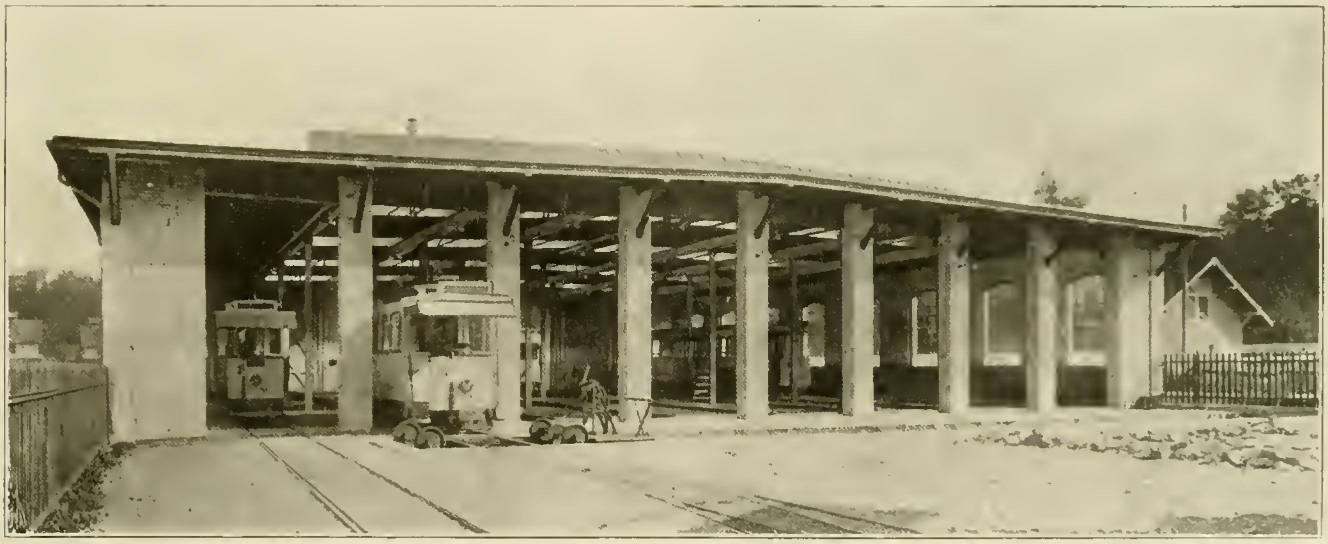
Where the soil is sufficiently thick, the roadway is built on an 8-in. bed of small stones. This bed is covered with a 2-in. layer of pebbles upon which the rails rest. In places where the resistance of the soil is insufficient, a bed of large stones is used and in some places special foundations have been built, the rails resting on a gravel bed 12 in. thick. At crossing points and at branches, the lines are paved and at points where water is liable to collect, special provision has been made for drainage. The gage is 3 ft. 3⅜ in. on tangents and is increased by ¼ in. on short radius curves. The minimum radius of curvature is 65.6 ft. and the center to center distance of the double tracks is 9.2 ft. except on the bridge where it is one foot less.

Two types of rails are used; the Vignol, weighing 70 lb. per yd., on the line between Lucerne and Kriens where freight cars are operated over the same track; the Phoenix, weighing 108 lb. per yd., on the other lines. The gage of the track is kept uniform by tie rods placed 7.8 ft. apart on tangents and at a suitable shorter distance on curves. The track switches are left-handed and those at the depot and the termini are of the double-throw type. The switches are all of 164 ft. radius and located in such a way that the car when entering the switch is not thrown out of its course. The length of the track at turn-outs is 262.4 ft. from point to point of switch. Special care was used in placing the switches on account of the freight trains which must be operated over the same track. The total number of switches is 30.

Overhead Construction.

For the overhead work 115 plain iron poles and 108 bracket poles were used. The line is divided into six independent circuits, each of which consists of two copper conductors doubly insulated from the ground. The use of double conductors makes it unnecessary to splice the wires and thus almost completely avoids the throwing off of the trolley.

The minimum height of the line above the ground is 19.6 ft. In the town the trolley wire is suspended by means of steel span-wires, held either between two fixtures on the houses or between two poles at the sides of the street. The tension in the trolley wire is such that there is a deflection of but 10 in., at normal temperatures, between two points of suspension 125 ft. apart. The steel suspension



FRONT OF CAR-HOUSE, SHOWING TRANSFER TABLE.

wires are pulled up until the deflection is equal to 1/15 of the difference between the two points of suspension. The strength of the iron poles is such that for a height of from 23 to 26 ft. above the ground, the maximum deflection is about 5 in. Poles with arms 16.4 ft. long have been placed at the Schweizerhofquai, great care being required in their erection. The poles are set in a foundation composed of gravel and portland cement. The heavy poles are set to a depth of 5 ft. 10 in.

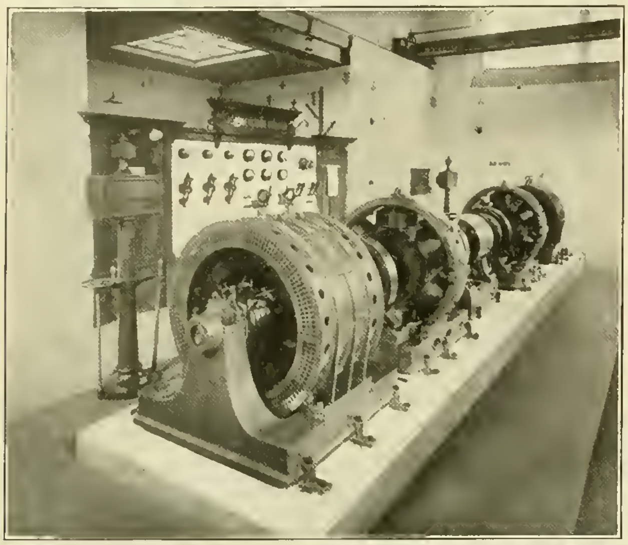
In places where circumstances permit, the span wires are attached to the houses by means of rosettes fastened into the masonry with three bolts. In order to avoid the transmission of vibration to the walls, sourdines are inserted in the span wires and at some places the wire is replaced by a steel cable. At the crossing of the electric line with the steam railroad the trolley wire is mounted on insulators placed in a wooden trough which is suspended from the bridge. The rails are connected by copper bonds and are also cross-bonded. The cables carrying the current to the six parts of the system are doubly protected with lead and have also iron sheaths. These feeder cables are provided with lightning arresters at their ends and along the line, placed in iron boxes fixed either to the houses or to the poles.

Equipment.

The rolling stock includes 20 motor cars and two cars without motors which may subsequently be so equipped, one car for distributing salt and a snow plow. The trucks have four wheels and are built according to the American system. The car rests on 12

springs, four of the springs being laminated while the others are spiral. This double system of cushioning is sufficient to absorb the jars produced at the rail joints and at special work. The brake rigging presses simultaneously eight cast iron shoes against the treads of the wheels, and where a trailer is used the two cars may be braked from the motor car by means of electro-magnetic brakes.

The cars are closed at both ends by sliding doors and accommodate 16 persons inside and 13 on the platforms, an iron bar closing the platforms in order to avoid accidents. The length of the car body is 13.12 ft., the length of the entire car over platforms 22.30 ft.



INTERIOR OF CENTRAL STATION, SHOWING MOTOR GENERATOR SETS.

and from buffer to buffer 24.54 ft. The cars are 6.3 ft. wide, 10 ft. high and weigh, with complete equipment, 7.2 tons. As there are curves on the line with a radius of 65 ft., the buffers have been so constructed that the cars may take these curves with ease. The equipment of the motor cars consists of two motors, two switches, a fuse and a lightning arrester, also electric heating and lighting devices. The two motors of 20 h. p capacity each are enclosed in cast iron cases and connected with the axle by gears having a ratio of 1 to 4.5.

The series parallel control system is used. There are seven different steps of resistance for running and four for braking. In addition there is a special switch for throwing one of the motors out of circuit and operating the other with a part of the resistance.

The current is collected by a trolley so designed as to insure contact if the wire is 9.8 ft. from the middle of the car. This limit, however, is never reached.

For heating the car there are two resistances which absorb 600 watts, and for lighting there are 10 incandescent lamps per car, eight in the interior and one on either platform.

Located near the Bireggstrasse is the building which contains the administrative offices, repair shops, lodging for the superintendent and storage room for the cars. The grounds have an area of 1,155 sq. ft., upon which, in case of necessity, a second car shed may be constructed. The depot building is constructed of brick. On the ground floor there is located the office of the superintendent, a room for the conductors and motormen and a reading room. The remainder of the ground floor is occupied by the repair shops, lavatories and baths for the employes.

The motive power for the shop is furnished by a 12-h. p. motor. The iron working shop contains a track for running in the cars and the tools consist of a lathe, a drill press, a planer, a grindstone and a small traveling crane. All the workshops are lighted from above. The boilers for heating are located in a basement and the entire building is lighted by electricity. The car shed is amply lighted and can accommodate 32 cars. It is connected with the workshop by two large sliding doors and contains eight parallel tracks under which there are pits for examining the motors and the car trucks. There is a transfer table in front of the car shed.

At the beginning of operation the cars were run on seven and a half minute headway, and this was later reduced to six minutes. After nine o'clock in the evening the headway is increased to nine minutes and on the line to Kriens it is always nine minutes.

The fare between points in the town is 10 centimes and varies from 15 to 25 centimes between the town and suburban points reached by the line. In spite of this low rate rebates are also allowed which considerably reduce the fare. Since the opening of the line, the traffic has increased to such an extent that it will soon be necessary to enlarge the central station and increase the rolling stock. The entire system was contracted for by the Oerlikon Co. of Switzerland.

Object of Railway Accounts and Statistics.*

BY J. L. BURGESS.

In the mass of figures that make up the returns of railroads we find the measure of their success or failure. It is not probable that the statistics of any two railroads are alike except so far as they are compiled for governmental purposes, and even in the latter case they are only generally alike, because uniformity is impossible—inherent obstacles prevent it.

To understand the statistics of railroads requires infinite patience, attentiveness, perception; the power of thinking consecutively upon dry subjects. These qualities, while not uncommon, are rarely exercised. Men jump at conclusions rather than undergo the fatigue of study. Correct understanding requires continuous, painstaking and exhaustive toil. Statistics are like accounts. The latter cannot be explained; they must be pored over as we would study an algebraic problem. Only men driven thereto or who possess a stout resolution are able to do this. The incentive must be great. Because of this, men who are not experts devote only such attention to the subject as necessity compels. Want of knowledge in matters of this kind is not considered a reflection upon their industry or capacity; rather the contrary. Because of this those who have charge of accounts and statistics should be moderate; careful to separate the essential from the non-essential; that which can be profitably studied by owners and managers from that which is immaterial. They should, above all things, strive to make their exhibits clear, to avoid burdening them with cumbersome matter that may prevent that which is valuable from being perceived.

Statistics are the electric lights thrown on industrial and social affairs, illuminating the acts of all concerned. The supervision of the owners of railway properties is impossible without this light. Pinching economy, a little money saved by curtailing statistics, may be a shield behind which thousands of dollars will be frittered away. It is impossible to analyze the affairs of corporations without the aid of statistics. The information compiled in this direction has, of course, different values. Many statistics that one company esteems important are omitted without thought by others. Some companies have practically no statistics whatever. I know an instance where a company in straitened circumstances abandoned all its statistics. Generally speaking, however, such action is impolitic. It could not save a company from failing and might precipitate bankruptcy. Under every condition of affairs corporations will do well to maintain full sources of information in reference to their workings. It will induce economy and heighten the effort of managers and employes.

Statistics are conducive to good morals and efficiency.

Much of the statistical information embodied herein is fundamentally indispensable to every company, whether rich or poor, little or big. Without it the affairs of a corporation may be all right, but its real condition can only be a matter of surmise. To say that such a state of affairs is demoralizing in corporate life is to put it mildly.

Some of the tables embrace information that may be termed of minor value. The enumeration is far from complete. Railway statistics are illimitable.

When managers have the time and disposition to study and profit by what statistics tell, money expended in compiling them is well invested.

A necessary concomitant of efficient management of railway property is a thorough and effective system of accounting—one that takes cognizance of every dollar earned or spent and subjects it to analysis, not spasmodically but uninterruptedly.

The English system of appointing temporary auditors to examine

*From a lecture delivered at the Iowa State College.

into the accounts of railroads at the close of the year and report to the owners is, in certain respects, a delusion of railway management. It deceives both the owners and the public, for the reason that in order to understand the affairs of a railroad through the medium of accounts, or to know at least, whether the accounts are rightly kept or not, they must be followed in detail from the commencement to the end, item by item, day by day, week by week, month by month.

No one can go into the office of a railroad at a particular time and audit its affairs. They must be audited as they occur.

The accountant who does this is the real auditor. Others may see whether he is efficient or not, but they must look to him for a true history of the company's affairs. He is its real historian, the real auditor. He alone knows whether the conclusions arrived at are authentic or otherwise.

Effective accounting requires such careful and systematic classification as may be necessary to afford a fair exposition of receipts and expenditures. For the practical uses of the management the accountant must carry his analysis far beyond this, so far as labor, material and their outlays are concerned. Published expositions suffice for the stockholder because he has neither the time nor appliances for probing the subject further. But the management must be thoroughly and systematically posted in every detail, or irregularities will creep in that no one would otherwise suspect.

The balance of cash or investments thereof that remains in the treasury after paying operating expenses, taxes and fixed charges constitutes net income. This is the goal. Here lies the essence of accounting. It is the duty of the accountant to verify these figures, to certify to their correctness; to gather every dollar of earnings, to see that no dollar is expended that is not duly and properly embodied in the accounts.

Bookkeeping was an afterthought; a device for recording and classifying affairs and preventing roguery. While resulting generally to the great and permanent advantage of business, the methods were, in many cases, unnecessarily elaborated. This had for its object, originally, a mere scientific elucidation of the mysteries of management. But with the lapse of time, and the opportunities the subject afforded, the primary intent was, in some cases, partially perverted through the efforts of accountants to mystify their superiors and otherwise aggrandize the offices they held. The gratification of the morbid hallucinations that often characterize men of sedentary habits had also much to do with the complications that resulted. However, every day we get onto more solid ground.

Books of accounts are necessary to corporations for the purposes of identifying the money that passes through the hands of different agents. Men who work for corporations must not only be honest, but must also be able to demonstrate it. When accounts go beyond the purpose of records they become statistical.

Corporations, including governments, are, for obvious reasons, compelled to pass beyond the original or primitive basis of keeping account of what they do and what their agents do. And in this lies the opportunity of the theorist.

So far as the fiscal affairs of a railroad are concerned, the summarization of the balance sheet shows how few and simple are its natural headings. On the debtor side is the cost of the property. But this does not necessarily embrace more than one item. Passing on, separate accounts must be opened with each agent and corporation in the company's debt. Fuel and material need not necessarily be separated; they may be bulked under the head of supplies. On the other side of the balance sheet appear the various classes of shares and bonds. These are succeeded by the current or floating liabilities. The list is closed by the income account, representing the amount of cash, or investments thereof, remaining after satisfying the fixed and incidental charges of a company.

All other accounts (save such as affect particularly assets familiar with the myriad details buried under each of the general or liabilities) are statistical in character and purpose.

This statement will seem like an exaggeration to those headings named in the balance sheet. The explanation is simple: The statistical information of railway companies has become, by long practice, so rooted into their general system of bookkeeping that it is mistaken by many for a fundamental basis. The income item, to illustrate, embodies all the working accounts. It is a summary of receipts and expenditures for the period it covers. All the accounts incident to it are poured into it. It is, in fact, a crucible into which details are dumped for the purpose of ascertaining results. But before this the details have been passed and repassed through many sieves of different degrees of fineness. Are these latter necessary? Could efficiency be maintained if they were abolished? Why, for instance, are not current receipts credited and expenses charged directly to profit and loss (income account)? Expense would certainly be saved and the service otherwise simplified thereby.

The explanation of current practices lies in the necessity of identifying the items of receipts and expenditures for purposes of reference and comparison, and to demonstrate the fidelity of each agent concerned.

Primarily railway accounts are classified so as to enable owners to judge with intelligence of affairs; itemization affords a basis for calculating the future of the property, and determines generally the faithfulness and intelligence that characterizes the management.

The division of expenses is not of so great importance to managers as is generally thought. It is valuable to them as a resume, generally speaking they are familiar with each account as it accrues. It is their business to prevent extravagance by anticipating it, not to await its development and exemplification in the returns. If, for instance, they awaited the slow process of accounting before cutting down the force in times of depression, the enterprise they represent would soon become bankrupt.

The attention of managers is directed to the present and future. Their view, generally, is prospective, they are men of affairs, not historical students. And herein they differ from the accountant or statistician, and it is fortunate for the world that it is so.

To the owner of a property, reliable statistics of a comprehensive character are indispensable. Without them he cannot determine its value or the worth of those whom he has intrusted with the management. It is as to the measure of these details, not their general necessity, that differences occur.

As regards the division of receipts practical unanimity exists. The rule seems to be to divide earnings into five general classes: Freight, passenger, mail, express and miscellaneous. In some cases, where the transportation of a certain commodity constitutes a large percentage of a company's traffic, the revenue therefrom is shown separately.

The particles that make up the earnings are exhibited in the returns with more or less perspicuity, according to the policy of the company, or the caprice of the statistician. Thus we frequently see tables exhibiting the direction of the traffic, as through passengers eastward, through passengers westward, earnings from the first class, second class, third class and excursion passengers, number of passengers to and from each station, the earnings therefrom, and so on, the tables following each other until details in regard to each class of receipts are thoroughly explained.

Disbursements involve many separate accounts in the office of the accountant. Some of these are unknown, except to him, and are, in fact, the scales with which he weighs results. They cannot be classified or explained.

The classification of expenses in published terms, if carried too far, has a tendency to confuse rather than enlighten the student. It is of importance, therefore, to restrict the items as much as possible consistent with due intelligence.

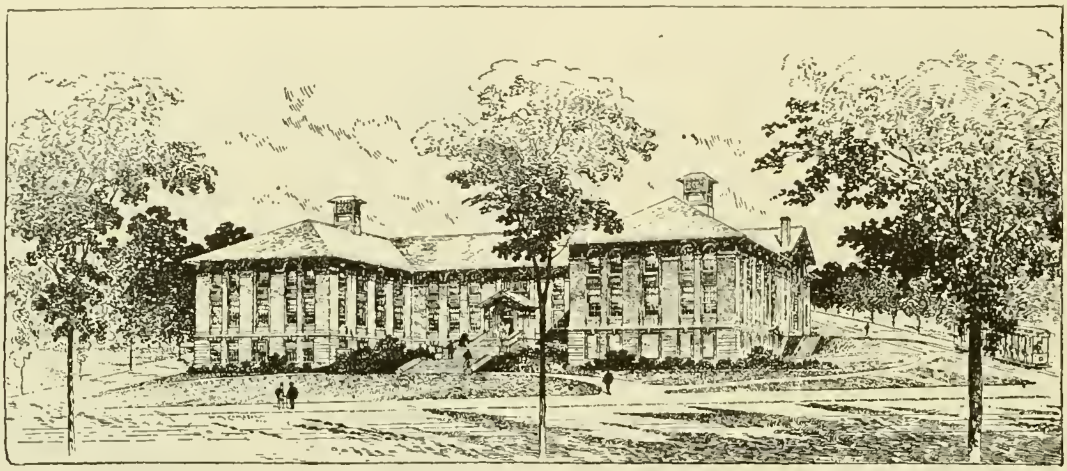
So far as correct methods of accounting are concerned, the amount of each collected for receipts or disbursed for expenses is immaterial. Returns of railroad companies should be based on the business done, the amount earned (whether collected or not) and the liabilities incurred during the same period.

Thus it will be seen, through the processes of accounting now in vogue, we have entirely abandoned primitive methods, which looked only to gathering the surplus cash without trying to trace the honesty or efficiency of those handling the business.

Written statistics, to be of practical value to managers, must be simple and easy of access. They are, so to speak, the pulse of a property and indicate the condition of the system whether it is strong and vigorous, or torpid and dull. It should be remarked, however, that the doctor must test the pulse of his patient personally to know its fluctuations and must apply his remedies without delay. It would be of little benefit to a man sick with a fever to have a system of recording his pulse that kept his condition a secret from the doctor for weeks after the tests were made. Railway property occupies the position of such a man. Essential facts in regard to it require to be known as they occur, not tomorrow, but forthwith.

Electrical Engineering Laboratories and Electric Railway Testing Plant at Worcester Polytechnic Institute.

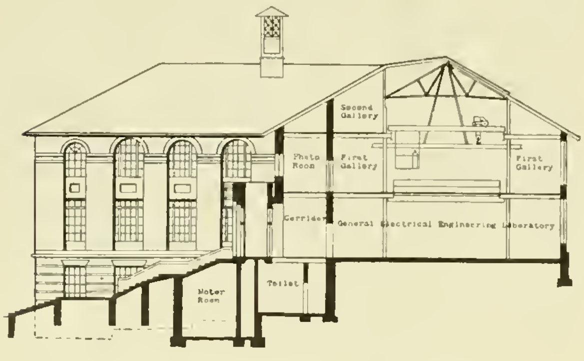
The board of trustees of the Worcester Polytechnic Institute recently awarded the contract for the erection of a new electrical engineering building, which upon completion will house very complete electrical engineering and electric railway engineering laboratories. This building will cost about $125,000, and it is expected that most of the laboratories will be ready for use early in the next college year.



NEW ELECTRICAL ENGINEERING BUILDING OF THE WORCESTER POLYTECHNIC INSTITUTE.

The laboratories have been planned by the members of the electrical engineering department of the institute, with Peabody & Stearns, Boston, as architects, and Prof. A. W. French of the civil engineering department of the institute as consulting engineer and superintendent of construction.

The accompanying engravings show the floor plans and an exterior view, and give an idea of the general appearance of the building, which will be constructed of selected red brick, with darker red brick and brown stone trimmings and a roof of light green slate. The location chosen is at the northern end of the campus, facing upon Institute Park. The building comprises a central portion, which is occupied by the general laboratory, and two wings. In the basement of the eastern wing are three rooms for class work and two offices, the former being arranged either for lecture work before small classes or for use as laboratories as the need of the department may require. Present plans contemplate fitting one of these rooms as a telephone laboratory and devoting another one to magnetic testing.



SECTION OF ELECTRICAL ENGINEERING BUILDING.

Under the east end of the general laboratory is a storage battery room, and provision for the storage of heavier apparatus which may be placed on this floor by the electric crane traveling over the general laboratory above. Toilet and locker rooms and heating equipment are near the center of the building, under the main entrance vestibule and stairway.

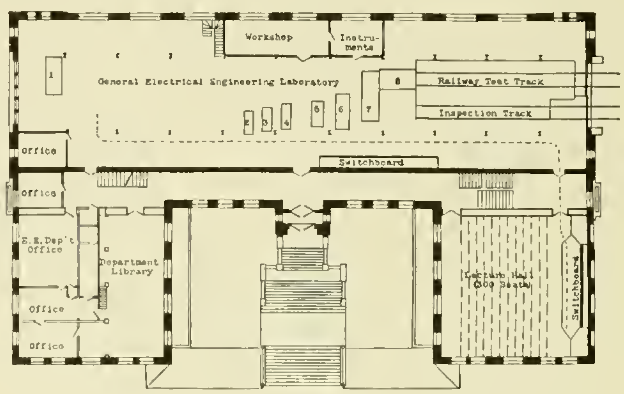
In the western wing, at the right and under the lecture hall, is the standards laboratory, equipped with standard reference instruments and apparatus. The more exact work of calibration and standardization will be done here. At the extreme western end, under the lower portion of the lecture hall, is a large storage room. A portion of the basement may be used for a photometric laboratory.

Under the western vestibule is a fireproof vault for the storage of records, lecture notes and manuscript records of experimental data, and the most valuable and delicate instruments of the department. The pit for the two railway tracks entering the general laboratory above, appears in the basement plan.

Examination of the first floor plan will show the arrangement of three features of special importance:

1. A large general laboratory, 200 ft. long and 55 ft. wide, which, with the three galleries shown in the transverse section, has a floor area of 19,400 sq. ft. and a volume of about 400,000 cu. ft. (The whole building has a volume of about 1,000,000 cu. ft.) This laboratory is served by a 10-ton electric traveling crane covering the entire central portion between the galleries.

2. In the west wing of the building is the lecture hall, designed to seat comfortably 300 persons. There is a difference in level of 8 ft. from front to back of the room, so that a good view of the demonstration table is to be had from every seat. Behind the demonstration table is a switchboard controlling circuits connecting with any equipment of the department, and the power units of the power laboratory. An overhead trolley hoist will transport heavy apparatus from the crane in the general laboratory to the demonstration table. Facilities for darkening the room and for the projection of lantern slides will be provided.



PLAN OF FIRST FLOOR OF ELECTRICAL ENGINEERING BUILDING.

3. In the east wing are the department library and the reading room. On shelving extending the entire length of the side next to the offices and upon the other wall spaces of the room, will be room for 3,000 volumes. This room is conveniently located for use in connection with the recitation and electrical engineering design rooms immediately above, the general laboratory opposite or the

several laboratories in other parts of the building. Most of the department offices are located upon the first floor and along the east end of the building.

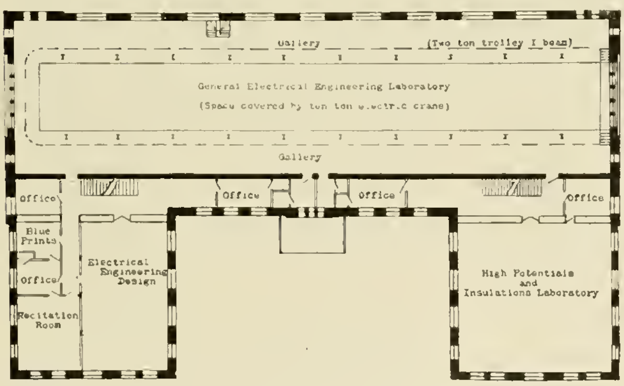
In the west wing, on the second or upper floor of the building (actually the third floor of the two wings), is a large laboratory for high potential and insulation work. Here will be high potential transformers, permitting the use of current of any desired frequency and potential up to 750,000 volts, for the study of the various problems of long-distance, high potential power transmission, and the di-electric and electrostatic phenomena of insulating and other material. It is proposed to develop this work on a most comprehensive scale, and the institute will devote especial attention to the study of very high potential phenomena.

By reference to the plan of the first floor of the general laboratory, it will be seen that all of the heavier apparatus is arranged in the central aisle, under the traveling crane. The galleries are designed to accommodate the lighter and accessory laboratory equipment, such as the switch signal, air brake and controller apparatus for electric railway work, the arc-lighting apparatus, transformers, and all other equipments not having heavy rotating or reciprocating parts. These galleries throughout their entire length are served by two-ton trolley hoists, the trolleys being arranged so that a load may be readily transferred from the traveling crane, which serves the main floor. Ample and convenient space has been provided for a workshop and instrument room on the main floor.

On the main floor plan, numbers indicate some of the larger stationary apparatus. Numbers 2, 3, 4, 5, and 6 are generators of from 30 to 60-kw. capacity, each direct connected to induction motors receiving power from the institute service power plant, which is located in another building on the campus. These generators are 110-volt and 500-volt direct current machines, and single-phase, two-phase and three-phase alternators. Number 7 is a 300-h.p., two-phase, 60-cycle synchronous motor, driving a direct and alternating current generator, delivering 500-volt direct current, or 350-volt single-phase, 25-cycle alternating current. This machine will supply power for railway experimental and testing purposes.

Electric Railway Laboratory.

Two tracks, connecting with the tracks of the Worcester Consolidated Ry., and in that way with the electric railways of New England, enter the building at the west end. Both of these tracks are served by the traveling crane, and one, the inspection track, is for its entire length over a pit, which will facilitate work on the trucks, brakes or motors. The second track enters a testing plant, where the car under test is supported on 36-in. wheels, the rims of which are of the same section as the top of a 100-lb. A. S. C. E.

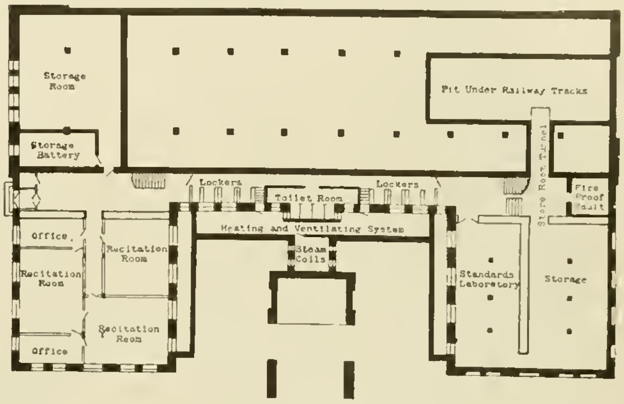


PLAN OF SECOND FLOOR.

standard rail. These supporting wheels are mounted on axles which revolve in bearings carried by pedestals. These wheels can be moved to accommodate cars of any truck and wheel base, up to a maximum of 48 ft. between front and rear wheels.

Generators mounted on the pedestals and geared to the axles of the supporting wheels will provide the desired resistance. The use of generators for this purpose, in lieu of brakes of the ordinary type, has the additional advantage of keeping the rotation of the axles synchronous with one another. On each supporting axle will be mounted a flywheel the weight of which is capable of variation to conform to the weight of the particular car under test, so that in acceleration or retardation, the effect of the inertia of the car may be obtained. This installation is designed so that all of the actions of the equipment from the start, through acceleration, constant speed running, coasting and braking to a stop, may be studied while the car body itself remains stationary in the laboratory, the effects due to wind resistance and grades being obtained by means of varying the loads on the generators geared to the axles of the supporting wheels. A traction dynamometer, to keep the car stationary directly above the supporting wheels, and to measure the drawbar pull, is indicated by the number 8 on the first floor plan.

As a part of the railway laboratory equipment, the institute will own a double-truck, four-motor car of the high-speed interurban



PLAN OF BASEMENT.

type. The exterior of this car will resemble an ordinary interurban car, but instead of being equipped with seats for passengers, the interior will contain special recording apparatus for automatically registering speed, distance, voltage, current, etc., whether operating on the laboratory testing stand, or on the lines of an electric railway. The car will also be fitted for making tests of bonds, feeder losses and other physical determinations of the track and electrical systems passed over.

As the testing stand will be arranged to accommodate any electric car, and the test car can operate on any standard gage track, the connection of this laboratory with any of the New England railways by means of the tracks of the Worcester local street railway will be of practical advantage to these railways, as well as providing the institute unexcelled facilities for instruction in this branch of engineering.

Besides the motors and the controlling, lighting, heating and braking apparatus permanently mounted on the test car, various other makes and systems of such apparatus, as well as signaling apparatus and overhead and third rail and track material, will be comprised in the laboratory equipment, so that tests may be made on various systems under different conditions of service. A system of wires and pipes will enable the test car to be operated, while on the test stand, by any of the control or air brake systems outside of the car, if desired.

Recent Changes in the Department of Electrical Engineering at Cornell University.

The trustees of Cornell University have recently assigned to the department of electrical engineering the major portion of Franklin Hall now occupied by the department of physics. The electrical engineering department will thus be supplied with new quarters for conducting various lines of work. The electrical engineering laboratory will continue to occupy a part of the main building of Sibley College, the mechanical engineering building, as Franklin Hall does not contain sufficient floor space to accommodate all the apparatus. The electric railway section will, however, be moved to Franklin Hall. This department will be equipped with a full line of railway motors, manual and multiple unit control systems, trucks and brake equipment, and all other devices necessary for instruction in this line of work.

"Sixty-five miles of electric railway without a railroad crossing" is the announcement which the recently issued advertising card of the Indianapolis & Cincinnati Traction Co. bears.

Finance and Accounts.

CONDUCTED BY HENRY W. BROOKS, JR.

(Mr. Henry W. Brooks, Jr., 15 Wall St., New York City, is a public accountant, auditor and specialist in financial and physical examinations of railway, public service and industrial properties.)

Advisability of Bonding Conductors.

While the collection of revenue has been greatly safeguarded in many ways by accounting methods and mechanically through the use of the most improved fare registers, a number of electric railways take the additional precaution of bonding their conductors. This is done principally to secure protection from loss through the theft of currency in the hands of the conductors, but of course the bond also covers loss through defalcations, such as the manipulation of transfers.

Of the companies coming under the writer's observation, about 45 per cent bond their conductors in one form or another, and consider their action the part of prudence. The moral effect of being under bond is also considered good. The lack of permanency of employment of conductors tends to add to the liability of loss, and in many cases the more or less superficial investigation of previous records and references of applicants, makes it very desirable to bond the men. The company's investigation of applications is, when the men are bonded, supplemented by the special investigation of the surety company.

The early method of requiring a cash deposit of from ten to twenty-five dollars is now more rarely used, being superseded by individual or surety company bonds. The small amount of the cash deposit is inadequate in the event of the perpetration of any systematic fraud, and small as the amount is, is often an inconvenience to the men.

Another method now largely used is that of the individual bond of one, two, or three persons, often friends of the conductor and furnished by him. In practice these bonds are often accepted without proper investigation, many "straw" bonds passing with the genuine, and when the time arises for seeking recovery thereunder, such bonds are found to be worthless or the source of delay and endless controversy in effecting settlement.

The bond of a surety company is considered a very desirable form of protection and simple in operation. The railway management is relieved of the trouble of minute investigation and can rely on the surety company in the event of loss. The form generally used is what is termed a "schedule bond," covering the entire force of conductors for a stipulated amount on each, each employe being listed, with the amount covered set opposite his name. The railway company notifies the surety company of each addition to the force and receives the surety company's acceptance of the risk. It is understood that the Schenectady Railway Co. bonds its men under this form, for $50 each and finds the plan to be simple and satisfactory.

The surety companies decline to issue the "blanket" bonds, that is, indemnifying against a loss on one man up to the face of the entire bond. The bonds required, range in amount from $50 to $500 on each conductor, the majority being for either two or three hundred dollars. The Public Service Corporation of New Jersey requires only $150, while the Springfield & Xenia Traction Co. requires $500. Under the plan of accepting individual sureties, it is customary to require more than one bondsman, usually for two or three hundred dollars cash., making a total security of four or six hundred dollars, respectively.

One objection raised to the use of surety company's bonds, is the delay in making investigations and accepting the risk, but this is found to be occasioned largely by the character of the applicants' references or necessity for long distance correspondence. Some surety companies will, however, make special arrangements with railway companies to accept the obligations immediately upon the receipt of the notification, and pending investigation, with the understanding that reasonable caution will be exercised in the selection of conductors.

The cost of bonding varies, but a fair premium may be stated as about two dollars on bonds of conductors up to $500, provided that the business on receivers, cashiers, paymasters and other higher grade risks is included. Companies taking out policies on a large number of employes usually get very reasonable rates of premium. The rate is also less in cities such as New York, Chicago, Baltimore, Philadelphia, than cities more distant from the offices of the surety companies. Where the amount of bond is small and men have left the service, rebates on their unexpired bonds are seldom given, but sometimes an arrangement is made to have the successor covered under the same premium, a small extra charge being made for the investigation only.

One of the smaller roads paid in premiums last year, $115, and had three losses through dishonesty, amounting to $85, but considered the bonding a good investment because of its practically limiting the company's losses to the amount of the premium, and adding a good moral effect to the personnel. During the previous year this company's known losses aggregated $168.

In general, it may be said bonding is becoming more customary and is an additional insurance against loss of earned revenue.

The Annual Report of the Honolulu Rapid Transit & Land Co.

The Board of Directors of the Honolulu Rapid Transit & Land Co. has recently issued its report of the operations of the company for the year ending Dec. 31, 1905. The length of the road in operation at the close of the year was 23.883 miles. Ten new cars were completed and placed in service during the early part of the year. There was also built and put in service an express car which has been operated in connection with the Wells Fargo Express Co. with very satisfactory results. In December the company began the construction of an oil tank car having capacity for 63 barrels in which it is proposed to transport the company's own fuel oil as well as that of other consumers throughout the city. This will effect a considerable reduction in the cost of fuel in addition to which there will be a profit derived from the transportation of oil to others.

The gross earnings of the company were $14,544 and the net earnings $5,470 per average mile of road operated. The operating expenses exclusive of taxes were 62.39 per cent of the gross car earnings. The net income for the year was $71,440. The amount of capital stock outstanding to Dec. 31, 1905, was $1,150,000. The outstanding funded debt on Dec. 31, 1905, was $690,000. An aggregate of $20,564 has been expended during the year in improving the company's property and increasing its transportation facilities. During the year there were carried 6,494,936 passengers, the total passenger revenue being $319,112. The revenue from freight traffic was $1,120, being an increase of $145 over 1904. The net earnings from the single car express service amounted to $196.

Fourth Annual Report of the Pittsburg Railways Co.

The fourth annual report of the Pittsburg Railways Co. for the year ended March 31, 1906, shows that the gross earnings from operations have been $9,512,615 and that the total operating expenses and taxes have been $5,528,002, making the net earnings for the year $3,984,613. There was a total income from other sources of $84,556, making a total income of $4,069,169. The deductions from the total income were $2,350,167, leaving a net income of $1,719,002. The interest on the funded debt of the Pittsburg Railways Co. and its leased companies amounted to $1,676,104, and the resulting surplus for the year was $42,898.

During the year just passed 191,084,335 passengers were carried by the company. The car mileage amounted to 35,148,351 miles. The earnings per car mile were $.2687 and the expenses per car mile, including taxes, were $.1445, leaving a net earning per car mile of $.1242.

Railway Park Accounting.

With the increased investment in railway park property and the remarkable growth in patronage of such resorts, the necessity arises for a more complete system of accounting to cover such operations. A large number of roads, and especially those operating in the larger cities, are directly or indirectly interested in amusement park resorts, primarily for the purpose of increasing their traffic.

With the inceasing patronage has come the necessity for increased investment in the way of improving the quality of the parks and adding many new and costly attractions. In some instances the direct investment in park properties has reached several hundred thousand dollars; while in indirect cases like the Coney Island properties, the investment has long since passed the million mark.

Exclusive of the railway earnings from transporting the pleasure seeking throngs, the receipts from park amusements run into the hundreds of thousands of dollars. Therefore it is readily seen that for the conservation of the property investment, stimulating the patronage and economical operation of attractions, together with the prevention of misappropriation of receipts, it becomes of vital importance to introduce a proper system of accounting. At this time when the season is opening it is well to give the matter attention

The primary object of such an accounting system is to determine in general figures, the net profitableness to the railway company of the park investment. The secondary object is to so analyze the receipts and disbursements as to assist the superintendent in his management of the property. By such analysis and comparisons he can secure to the greatest extent the possibilities of the park, and immediately cut off any unattractive or unprofitable features and check any leaks in operating expenses. A proper accounting system is also of great importance in cases where working capital is limited or not provided for conducting the enterprise. In such parks the gate and amusement receipts would be depended upon to provide funds for conducting the enterprise.

Owing to the great diversity of such parks, their attractions, methods of operating and extent of patronage, it would be impossible to formulate a standard system of accounting, but in the limited space of this article, it is purposed to outline some of the principles and methods now in use. A small road, must of necessity use a very simple system, whereas a road operating a large park with many attractions should have a more detailed system.

Property Accounts.

Park properties are very diverse in their characteristics, but it may generally be stated that the property investment should be classified in such a way as to determine the net income on each parcel of land and equipment devoted to each attraction. The park properties are of two natures, (a) direct revenue producing and (b) non-revenue producing, and should be classified accordingly.

Among the former are included such attractions as:

Rustic Theater (land occupied, building, scenery and all other permanent equipment).

Ball Ground (land occupied, grand stands, etc.).

Dancing Pavilion (land occupied, building,* musical instruments owned. If cafe is attached, should be kept distinct under following caption).

Cafe or Restaurant (land occupied, building, tables, chairs, bar and other fixtures).

Roller Coasters (land occupied, structure, machinery, etc.).

Boating Property (land occupied, docks, steam or electric launches, canoes, and other pleasure boats, but not to include the lake property).

Bathing Houses (land occupied, bathing houses, floats, bathing suits, etc., but not to include the lake or beach property).

Carousals (land occupied, equipment, etc.).

Skating Rink (land occupied, rink, etc.).

Investment in Shooting Galleries, and numerous other attractions should be classified along the lines just mentioned.

Under the classification of Non-Revenue Producing Properties should be included the investment in land, buildings, equipment, etc., devoted to deer parks, menageries, training tracks, swings, groves, seats, summer houses and all other features of general attractiveness but not directly producing revenue.

Earnings.

While the establishment of an amusement park is a direct source of added gross earnings of the railway proper, yet such earnings will necessarily be shown under the system of railway accounts and not under the park accounting system. It is an essential feature of course, to know the earnings arising from this source. This is possible through the route analysis of earnings, or through the use of turnstiles at the entrance. As many cars are run directly into the park and there unloaded, the latter method is often considered

BLANK AMUSEMENT CO.

STATEMENT OF DAILY PATRONAGE FOR MONTH OF 190

Day of Month	1 Vaudeville Theater	2 Restaurant	3 Dancing Pavilion	4 Old Mill		Totals	Remarks (weather, etc.)
1							
2							
31							
Totals							

SUGGESTED FORM FOR STATEMENT OF DAILY PATRONAGE.

BLANK AMUSEMENT CO.

STATEMENT OF EARNINGS, EXPENDITURES AND INCOME FOR MONTH OF 190

No.	Attraction	Gross Earnings	Operating Expenses	Maintenance and Depreciation	Administration and Gen'l Expenses	Fixed Charges	Total	Net Income
1	Vaudeville Theater							
2	Restaurant							
3	Dancing Pavilion							
4	Old Mill							
43								
44								
45								
	Totals							

SUGGESTED FORM FOR EARNINGS, EXPENDITURE AND INCOME ACCOUNTS.

an inconvenience. However, at many places large crowds are passed through turnstiles or ticket gates without causing serious delay or inconvenience.

Where possible it might be well to show the patronage over company lines as distinct from that arriving over competitive lines or other means of transportation. Several beach resorts are thus served by competing lines of boats, electric and steam railways.

The earnings directly arising from different amusements should be properly analyzed, this being of vital importance in determining the attractiveness of each amusement feature. The popularity of each attraction must be closely watched, as explained hereafter, and therefore the necessity for this analysis.

The earnings should be classified along the following lines:

Gate Receipts (where charged to all patrons whether arriving by company's cars or otherwise; or where charged only to non-railway patrons).

Earnings—Theatre (gross receipts).

Earnings—Ball Ground (gross receipts).

Earnings—Dancing Pavilion (gross receipts, where dancing privileges are not free. If doing a very large business a regular restaurant checking system may be used and this account subdivided (a) Food, (b) Wines and Liquors (c) Cigars).

The gross earnings from other attractions may be classified along similar lines. In many instances, without a proper system of accounting, earnings are misappropriated by employes, the nature of the business affording many opportunities.

A very good method of overcoming this difficulty is by selling all tickets at booths and collecting these as admission to each attraction. In a smaller park where a ticket system is used, it is most economical to have a uniform admission charge of say five or ten cents and sell tickets at a central booth located at the entrance of the park. A strip ticket, about one by two inches is the cheapest and most convenient. If it is desired to charge different admission fees to different attractions five-cent tickets may be sold in quantities at the booth and the respective amount collected at the entrance.

When the resort is a large one and well patronized, it will be found more convenient and almost as economical to have ticket booths distributed over the park or one for each attraction. Every inducement and facility must be afforded prospective patrons, and therefore ticket booths should be distributed accordingly. Combination tickets, good for all attractions, sold at a somewhat reduced rate are an inducement to patronage.

An accounting system can be devised to care for these combination tickets and show the patronage and earnings of each attraction.

Operating Accounts.

The amusement business necessitates a liberal policy to insure success, but at the same time it affords frequent opportunities for unnoticed waste and lavish expenditures. The relation of cost to patronage must be carefully watched. An operating account, conforming to the classification of property and revenue account should be opened for each attraction and to these respective accounts should be charged items of direct operating expense, such as wages of attendants, supplies, salaries of actors for the theater, music for the dancing pavilion, food, wines, cigars, etc., for the restaurant, etc.

Maintenance and Depreciation.

Some very interesting questions arise in connection with the maintenance and depreciation of amusement park properties. In the first place, there are a great number of distinct parts, each having a different life based on deterioration due to physical causes. But the heaviest and most uncertain losses arise not through this cause, but through the failure of different amusements to draw patronage. The nature of the amusement business is a fickle one and apparently amenable to no known laws. The most novel and promising attractions often fall flat and render the first cost, usually heavy, a dead loss.

Two accounts for each attraction and non-revenue producing property must be kept, one for the ordinary maintenance of the property in its original condition and the other for depreciation. To the former should be charged all ordinary repair renewals, such as are customary at the beginning of each season. Never let anything get shabby in an amusement park. Fresh paint is a cheap drawing card.

No general percentages of depreciation can here be stated as they would tend to mislead. These must be worked out for each park and each attraction. The rates of depreciation on such permanent property as restaurant buildings, grand stands, steam launches, etc. are very different from those on untried attractions, mostly of a spectacular nature, erected for but one or two seasons only—possibly not continued that long.

Administrative and General Expenses.

The administrative and general expenses of a park enterprise generally include such items as "Supervision and Clerks" (proportion of salary of superintendent, or where the size of the park warrants the salary of a man who devoted his entire time during the season to the direct supervision of the park and amusements, also salaries of clerks, ticket sellers and collectors), "Wages of Attendants," (such as park guards and general labor not otherwise chargeable), "Printing and Stationery" (used in connection with the park), "Advertising" (in newspapers, by special park periodical, handbills, etc.), "Lighting" (cost of the general lighting of the park), "Fares" (on park property and equipment), "Insurance" and "Interest" (on funds invested).

If so desired, these administrative and general expenses can be prorated on the proper basis directly against each attraction and thus show the net profit from each amusement feature.

The value of amusement park accounting lies in its clear, daily analysis and comparison of earnings, patronage and operating costs. Unless the proper forms are devised to clearly and accurately exhibit these conditions, and the bookkeeping work kept up to date there will be but little value returned for the outlay in time and trouble. Once a proper system is designed to meet the individual requirements of the particular park, but little clerical expense is required for keeping it up, and if the management will watch the daily tabulation of results and act on the figures there shown, the best possible results may be obtained from the park and its equipment. Such accounting also gives a basis as to what class or character of attractions to add and what to discard the coming season.

Appreciation of Real Estate Values.

The question of the propriety of appreciating values of real estate owned by electric railways was raised in connection with some recent examinations of three roads.

In the first case the real estate was used in operation of the road since the plot was occupied by the power house. The original property was purchased at the time of construction for $65,000. In the fourth fiscal year, the company appreciated the property $20,000 on the books by an entry debiting the construction account and crediting miscellaneous income, thus adding to the balance applicable to dividends $20,000. While contiguous property had legitimately advanced at a similar ratio in value during the four years, yet the company was not warranted in making such an entry on its books. The property was of no more value to the company for purposes of operation than before and no profit was earned until a sale of the real estate had been made. The sale would have been warranted had the company sold the property, as in the instance of a consolidation of some other roads where the power production was centralized at the most economical station and a cheap, uneconomical station was dismantled and the land sold for $12,500 more than original cost.

In the second case the real estate was used for an amusement park. A railway company bought a 45-acre tract of unimproved land a few miles from the city for $9,000. The interests in control of the road also operated in real estate and forming a real estate corporation bought at about the same price per acre an unimproved tract fronting on a lake. Owing to the popularity of the resort and the new railway facilities values enhanced. The real estate company subdivided its tract and sold lots at the enhanced valuation, or about double the original cost. The same parties being in control of the railway company, considered it proper to appreciate the value of the park property and did so on the books of the company, thus adding $10,000 to the valuation of the assets. The same comment applies to this case as to the former.

In the third case in question the real estate originally was purchased for a car barn and shop buildings but subsequently was partially sold. A railway upon commencing construction purchased a parcel of land at the suburban end of its proposed line for the

purpose of building a car barn and repair shop. Before construction was completed the company was threatened with a receivership. Owing to its inability to float the entire bond issue the new road passed into the control of the interests owning an operating road in the terminal city. The new owners connected the purchased line with their operating car barn and repair shop and the site of the proposed car barn was not utilized. Having an offer of $12,500 for half of the entire plot, which cost $18,600, they sold it. In closing the books at the end of the fiscal year a profit of $6,400 was shown by including the profit on the sold portion and by appreciating the value of the unsold portion on the basis of the same ratio of increase as the sold portion. The question was raised, "If we write off an amount for depreciation of buildings, as has been done elsewhere, why should we not write on a fair amount for the legitimate appreciation of land values?"

It is the writer's belief that the company was entitled to include the profit on the land sold, but not to apreciate the value of the remaining unsold portion.

Traffic Conditions in New York City.

The remarkable growth of traffic in Greater New York is shown in the following table, compiled from data furnished by the State Board of Railroad Commissioners for the first quarter of this year. The supremacy of New York as a traffic field is shown by these substantial figures. The statement further shows that these properties, under sound financial administration, should earn a fair return on the necessarily heavy construction investment.

A careful study of the accompanying table will show some very interesting traffic conditions

Briefly commenting thereon, it is seen that the gross earnings of all lines for the quarter were $14,866,958.25, an increase of $1,853,062.50 The average earniugs per capita per annum show the remarkably high figure of abont $17.00. It may reasonably be anticipated that the gross earnings for the current year will be in the neighborhood of $62,000,000.

The total number of passengers carried for the quarter was 297,339,165, an increase of 37,061,250 over the corresponding prior period.

The total car mileage was 56,998,216, or an increase of 6,522,434 car miles.

It was anticipated that the competitive operation of the subway would very materially cut into the earnings of the Metropolitan system. The first quarter of 1905 did show a decrease of 1,027,946 fares, but the 1906 corresponding quarter shows an increase of 8,769,413, or a net gain of 6,741,467, thus apparently showing that the Metropolitan surface lines have caught up with the traffic which the subway withdrew. In regard to transfers, 6,820,867 more transfers were issued during the quarter, but the total remains less than that for the corresponding period of 1904.

Some other interesting data furnished but not included in the accompanying table, show an increase of 238 transfer points, or 1,173 at present. The total number of employes was 30,442. The track mileage is given as 1,357.33.

	Borough of Manhattan.				Borough of Brooklyn				Borough of Queens.				Borough of Richmond.		
	N. Y. City Ry.	Interboro' Rap. Transit: Elev. Div.	Interboro' Rap. Transit: Subway Div.	Totals Boro' of Manhattan.	Brooklyn Rapid Transit.	Coney Island & Brooklyn Ry.	Van Brunt St. & Erie Basin Ry.	Totals Boro' of Brooklyn.	N. Y. & Queens County Ry.	Long Island Elec. Ry	Ocean Elec. Ry.	Totals Boro' of Queens.	Ssaten Island Midland R. R.	Richmond Lt. & R. R. Co.	Totals Boro' of Richmond.
Cash Fares	$9,454,011	65,733,985	41,029,733	196,217,729	80,184,600	6,520,794	418,310	87,123,704	3,379,883	599,305	95,022	4,074,210	603,535	966,670	1,570,205
Increase corresponding period 1905	8,769,416	3,219,025	11,491.007	23,479,448	10,021,446	323,111	21,285	10,365,842	615,110	82,556	35,667	733,333	110,967	154,061	265,028
Percentage Increase	9.83	4 90	28.01	11.96	12.49	4.95	5.08	11.89	18.19	13.77	37.53	18.00	18.38	15.93	16.87
Transfers	44,436,241			44,436,241	19,679,629	1,335.259	31,730	21,046,618	771,201			771,201	53,110	96,501	149,611
Increase corresponding period 1905	6,820,867			6,820,867	4,763,391	11,201†	2,873	4,771,719	182,903			182,903	9,001	13,910	42,911
Percentage Increase	15.34			15.34	24.20	.83		22.67	23.72			23.72	16.95	14.41	28.68
Car Mileage	13,620,424	15,253,524	8,469,144	37,343,092	14,723,417	1,406,494	53,549	16,183,460	828,246	184,495	48,340	1,061,081	274,730	286,237	560,967
Increase	1,382,099	1,117,729	1,498,505	4,028,333	1,646,438	87,833	3,617	1,737,888	102,964	21,199	14,154	138,617	64,388	29,799	91,187
Percentage Increase	10.14	7.50	17.61	10.71	11.11	6.24	6.75	10.73	12.44	11.49	29.90	13.06	23.43	10.41	16.79
Revenue Passengers per car mile	6.53	4.31	4.80	5.21	5.41	4.63	7.81	5.38	4.07	3.24	1.97	3.84	2.19	3.37	2.80
Revenue Passengers per mile track operated	285,795	557,067	594,633	392,435	146,589	120,756	275,540	144,484	45,674	21,791	14,619	37,724	21,946	34,524	28,292

†Decrease.

TABLE SHOWING GROWTH OF TRAFFIC IN GREATER NEW YORK FOR THE FIRST QUARTER OF 1906.

Annual Report of the General Electric Co.

The General Electric Co. has recently issued its fourteenth annual report, covering the year ended on Jan. 31, 1906. During the year orders were received for railway motors aggregating 750,000 h.p. capacity, of which 300,000 h.p. were heavy traction motors of 125 to 200 h.p. capacity each. The number of cars equipped with the Sprague-General Electric train control increased from 2,595 cars in 1904, and 2,997 cars in 1905, to 4,026 cars in the year ended on Jan. 31, 1906. The sales of Curtis steam turbines aggregated 214 turbines for domestic customers and 44 turbines from 11 foreign countries, making a total of 535 turbines ordered up to February 1st, of which 346 had been shipped to customers. The first car in the United States equipped with single-phase motors designed to operate with either alternating or direct current was placed in operation in August, 1904, since which time a large number of contracts for this equipment have been received. The first of the 35 100-ton locomotives for the New York Central Terminal was completed and on January 31st had undergone a mileage test of 29,568 miles, the total maintenance cost being about one-fourth the average maintenance cost of a steam locomotive; the actual running time 172 days and the average daily run 171 miles, the maximum for one day being 347 miles in 8¾ hours. Several contracts for long distance power transmission were received during the year and one for the complete electrification of a steam road from terminus to terminus, this being the West Jersey & Seashore Ry., 64 miles in length. The metallized filament incandescent lamp was brought out last year and constitutes a most important advance in the art of electric lighting. Improvements were made in arc lamps, regulators, meters, switches, controllers and other small articles of manufacture, as well as in other lines.

The company now has 22,500 employes, as compared with 18,000 last year and 17,000 in 1904. During the year $2,338,362 were spent for real estate, erection of new factories, extensions, new machinery, etc., and $431,247 for patents, use of patents and in patent litigation. There were also charged to profit and loss $1,000,000, leaving the company's patents, franchises and good will standing at $1,000,000. The actual business, as shown by the amount billed, increased from $12,730,058 in 1895, and $28,783,275 in 1901, to $43,146,902 in 1905. The book value of the plants at Schenectady, Lynn and Harrison in 1893 was $3,958,528, since which date there has been expended for additions and extensions $19,412,373; but during the same period there has been written off for depreciation $15,370,901, leaving the book value at present $8,000,000, of which nearly one-half is credited to machinery and the remainder to real estate and buildings. The balance sheet shows the following:

Earnings.

Sales	$43,146,902.42
Royalties, dividends and interest on stocks and bonds, and sundry profits	798,539.27
Interest and discount	300,781.55
Profit on sales of stocks and bonds	173,389.52
Surplus brought over from last year	6,569,196.48
Profit for the year ending on Jan. 31, 1906	7,319,160.61

Expenses.

Cost of sales (including depreciation of plants, $1,838,-362)	$37,025,346.61
Interest on debentures	75,105.54
Profit for the current year	7,319,160.61
Patents written off	1,000,000.00
Dividends paid in cash	3,861,062.00
Surplus on Jan. 31, 1906, carried forward to next year	12,027,295.09

Assets.

Cash	$ 6,356,093.77
Stocks and bonds	19,104,539.30
Real estate (other than factory plants)	359,013.86
Notes and accounts receivable	16,287,018.01
Work in progress	2,496,205.78
Merchandise at factories	14,983,710.46
At general and local offices	1,782,678.47
Consignments	155,901.91
Factory plants	8,000,000.00
Patents, franchises and good will	1,000,000.00
Total	$70,525,161.56

Liabilities.

3½ per cent gold coupon debentures	$ 2,047,000.00
5 per cent gold coupon debentures	55,000.00
Accrued interest on debentures	458.33
Accounts payable	2,106,863.89
Unclaimed dividends	1,794.25
Capital stock	54,286,750.00
Surplus	12,027,295.09
Total	$70,525,161.56

The Second Annual Convention of the Southwestern Electrical & Gas Association.

The second annual convention of the Southwestern Electrical & Gas Association was held in Galveston, Tex., May 16, 17 and 18, at the Tremont Hotel. About 75 members were present, which is the largest attendance at any of the conventions of the association so far held. President M. M. Phinney, general manager for the Stone & Webster properties at Dallas, called the first session to order on Wednesday at 10:30 a. m. Mayor H. C. Landes in behalf of the city, welcomed the association. The response on the part of the association was made by H. T. Edgar, of Ft. Worth. The election of new members followed and several applications were acted upon. There are now 83 active member companies in the association.

President Phinney then delivered his annual address in which he outlined the work and scope of the association and complimented Galveston upon the enterprise shown in its speedy rebuilding after the disaster of 1900. He said that there were many technical details in connection with furnishing electric light and power, water and gas to the public with which the majority of the public is not familiar. There are, therefore, many members of the legislature who are called upon to vote on measures affecting these interests without being fully informed concerning such matters. He recommended that a legislative committee be appointed. The duties of this committee would be to be ready to go before the committees of the legislature when an act is pending that needs any character of explanation and furnish to such legislative committees all the information which they may desire upon the subject.

Following the president's address, G. C. Gum of Ft. Worth, read a paper upon "Up-to-date Methods of Increasing the Business of Public Service Corporations." The paper pointed out some of the methods to be employed in getting new business to utilize the surplus energy at every central station. The "Question Box" was next taken up and questions relating to street railway, telephone, electric and gas plants were presented and discussed.

The afternoon session of the first day opened with the reading of extracts from a letter from Frederic Egner on "Retort House Practices." The Question Box discussions occupied the remainder of the afternoon.

The morning session of the second day opened with a paper by S. J. H. White entitled "What is Electricity?" The author presented this paper in a very interesting manner and took up at length his theories explaining various electrical phenomena. The next paper presented was that of Frank J. Duffy, manager of the Beaumont Traction Co. Mr. Duffy's paper was entitled "Relations of Public Service Employes to the Public." He said that public service employes should be intelligent and efficient and capable of adapting themselves to meet the peculiarities of the most unreasonable people, since the acts of the employe reflect either credit or discredit upon the company.

At the conclusion of Mr. Duffy's paper several questions from the Question Box along the same line were taken up. It was pointed out that it was necessary for the officials of the various companies to practice what they preached, as example counts more than anything else. The difficult position of the average electric traction trainman was discussed and it was pointed out that while the public is frequently at fault in its dealings with street railway employes, the company should not conclude that the employe is always in the right.

The afternoon session was taken up with the reading and discussion of a paper entitled "Care, Maintenance and Inspection of Street Railway Rolling Stock" by H. S. Cooper of Galveston. Mr. Cooper emphasized the necessity for inspection in order to prevent depreciation.

The Friday morning session opened with a paper by F. W. Yensen of the Southwestern Telephone Co., his subject being "Telephone Engineering Problems." Following Mr. Yensen, A. W. Q Birtwell of Houston, read a paper entitled "Organization and Operation of Purchasing and Supply Departments." The reports of Secretary Duffy and Treasurer Judge were read. The nominating committee then made its report and the following officers were elected: President, H. S. Cooper, Galveston, Tex.; first vice-president, J. W. McLendon, Fayetteville, Ark.; second vice-president, J. P. Crerar, Denison, Tex.; third vice-president, Samuel Kahn, San Antonio, Tex.; secretary, E. B. McGinnis, Dallas, Tex.; treasurer, A. E. Judge, Tyler, Tex. Executive committee: H. S. Cooper, J. W. McLendon, J. P. Crerar, Samuel Kahn, M. M. Phinney, H. T. Edgar, J. F. Strickland, R. B. Stichter, F. J. Duffy and E. B. McGinnis. Finance committee: F. M. Lege, J. J. King, W. H. Young. Advisory committee: J. A. Farnsworth, H. M. Littell, J. D. Oliger, W. H. Chapman, C. W. Ford, C. H. Dunbar, E. D. Kelly, C. W. Kellogg, E. M. Cooper, David Daly and W. B. Head.

The New Constitution and By-Laws of the American Street & Interurban Railway Engineering Association.

The newly adopted constitution and by-laws of the American Street & Interurban Railway Engineering Association have recently been placed in the hands of the members of the association by Secretary S. Walter Mower. The constitution and by-laws have been approved by the executive committee of the American Street & Interurban Railway Association and now conform in every respect to those of that association.

The constitution provides that membership in this association shall consist of two classes: active members, consisting of active members of the American Street & Interurban Railway Association, and associate members, consisting of associate members of the American Street & Interurban Railway Association who may elect to ally themselves with the Engineering association. All former members of the American Railway Mechanical & Electrical Association will be eligible to associate membership in the engineering branch of the American Street & Interurban Railway Association. Their relation to the Engineering association will be identically the same as it has been to the American Railway Mechanical & Electrical Association.

The organization of the Engineering association remains unchanged. It has not only been permitted to retain its identity, but its conditions and possibilities have been bettered in every respect. It has been thought wise by the executive committee of the four associations that individual membership should be confined to the Engineering and American associations. It has also been deemed best that this individual membership shall be such that members of this class shall be entitled to all the general privileges and printed proceedings of both associations.

Improvements on the Elevated and Surface Lines of the Brooklyn Rapid Transit Co.

The Brooklyn Rapid Transit Co. has, within the past few years, made large expenditures on its extensive system of elevated and surface lines in order to put them in a thoroughly safe and modern condition. Since July 1, 1902, the company has expended on the 463.8 miles of surface lines, 68.4 miles of elevated lines and on some subway work, approximately $22,000,000. Last year the sum of

ENTRANCE TO ELEVATED YARDS.

$8,000,000 was expended on existing lines, of which $625,000 were paid out for track, $1,800,000 for power station improvement, $900,000 for bridges and terminals and $1,000,000 for miscellaneous improvements. During the present year $7,000,000 will be expended of which $2,800,000 will be devoted to tracks and buildings, $1,650,000 to the power station and $450,000 to sub-stations. The work so far done has involved a number of improvements of considerable magnitude, the engineering features of which are of interest.

Among the locations offering interesting forms of construction is the junction of the elevated and surface lines at East New York, a layout of which is shown. At this point were located originally some engine and car houses of wooden construction. These are now being replaced by a two-story shop, inspection sheds and other buildings and by an elevated storage yard with a capacity for 270 cars and a surface yard with a capacity for 327 cars. Owing to the peculiar situation of the yards a rather complicated structure was necessary for giving entrance to the elevated yards from the main tracks. There is considerable traffic at this point, and, as it was necessary to use the connections constantly during construction, complications were offered both in design and erection.

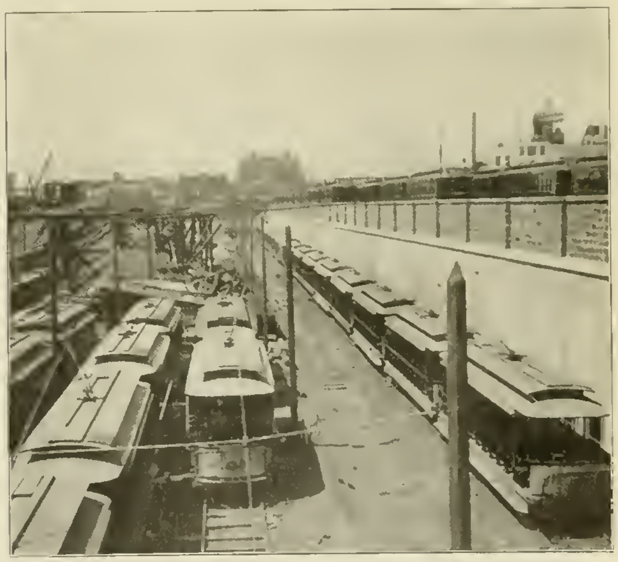
A feature of the new work is the installation of an electro-pneumatic interlocking plant similar to those in service on the Boston Elevated and the Boston Terminal railways, but employing some additional patents evolved by the Brooklyn Heights Railroad Co. On the elevated level, a short distance from the new signal tower, has been built a convenient structure for the offices of the signal engineer, trainmaster and dispatcher and containing rooms with lockers and other appurtenances for the use of trainmen.

Throughout the work the prevention of fire risks appears to have been prominently in the minds of the engineers. A concrete and hollow tile fire wall, which is indicated in the layout, separates the elevated and surface yards, both of which are divided into sections by four other fire walls, each reaching to a height of 15 ft. above the rails. The construction of the foundation of one of these walls is indicated in one of the accompanying illustrations. It consists of concrete piers spaced 20 ft. center to center, resting on firm earth foundations at an average depth of 18 or 19 ft. Upon these piers are placed concrete girders reinforced with two lengths of steel rail. All of the retaining walls, fire walls and concrete foundations throughout the work are constructed directly by the railroad company.

The construction of the shops and inspection pits developed some interesting problems. The pits are built according to standard practice and have a capacity for 48 cars. They are constructed entirely of reinforced concrete. The fact that the ground upon which this building stands is composed of loose ashes to a depth of 20 ft. and over made it necessary to carry concrete piers down to the original earth, in some instances to a depth of 28 ft. The side walls, which are of solid concrete, are carried on reinforced concrete girders resting on these piers, rail being used for reinforcement. The flooring has been given a greater sustaining strength than will probably be called into service. The inspection pit area is floored with concrete having rails imbedded at regular intervals, the whole resting upon floating foundations in the loose cinder filling. The tracks are placed with centers 13 ft. 3 in. apart and are eight in number. In one corner of the inspection shed has been built an armature winding room and bake oven. In the space adjoining the bake oven a water meter has been installed with four connections with the city water main, insuring the delivery of a plentiful supply of water to the system of hydrants in various parts of the yard.

There are two tracks on the upper floor of the shop which adjoins the inspection sheds, being separated from the latter by a fire wall. This upper floor is devoted entirely to the repair of cars, while the lower floor is devoted to the various departments of repair shop work. The equipment of the shop includes three large hydraulic lifts, which make the operation of jacking up one end of a car, lowering the trucks to the shop floor level and lifting a new pair into place, an operation of four minutes' duration. The shop is equipped with cranes and labor saving tools of recent design. The blacksmith shop contains 14 forges. The storehouse is at the northern end of the building and in separate buildings are the lamp room and oil storage house. The feature in the construction of the shop building to which attention is directed is the two-inch wire lath and plaster wall, together with the fireproof brick walls dividing the building into sections.

Another interesting feature at this location is the provision which has been made for heating all of the buildings. On the east side of Gillen Place, opposite the shop, is an ash-collecting station which is one of many distributed throughout Brooklyn. The street clean-

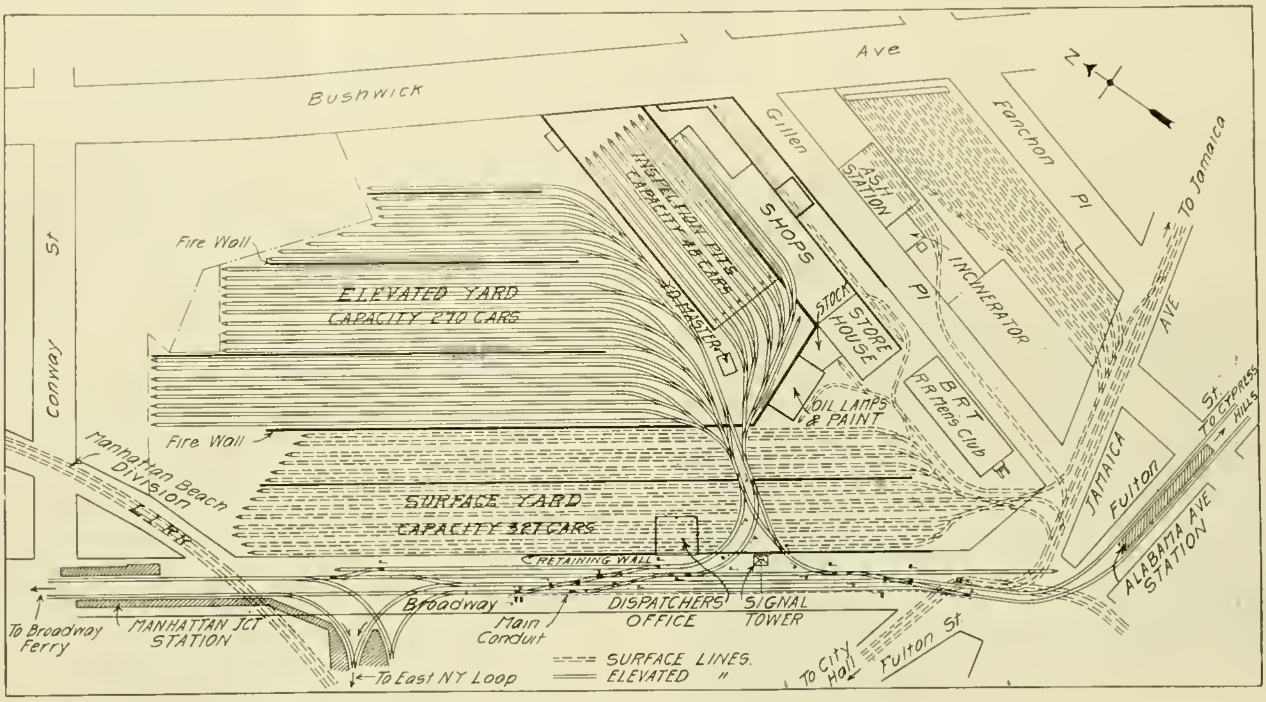


CONCRETE RETAINING WALL BETWEEN ELEVATED AND SURFACE YARDS.

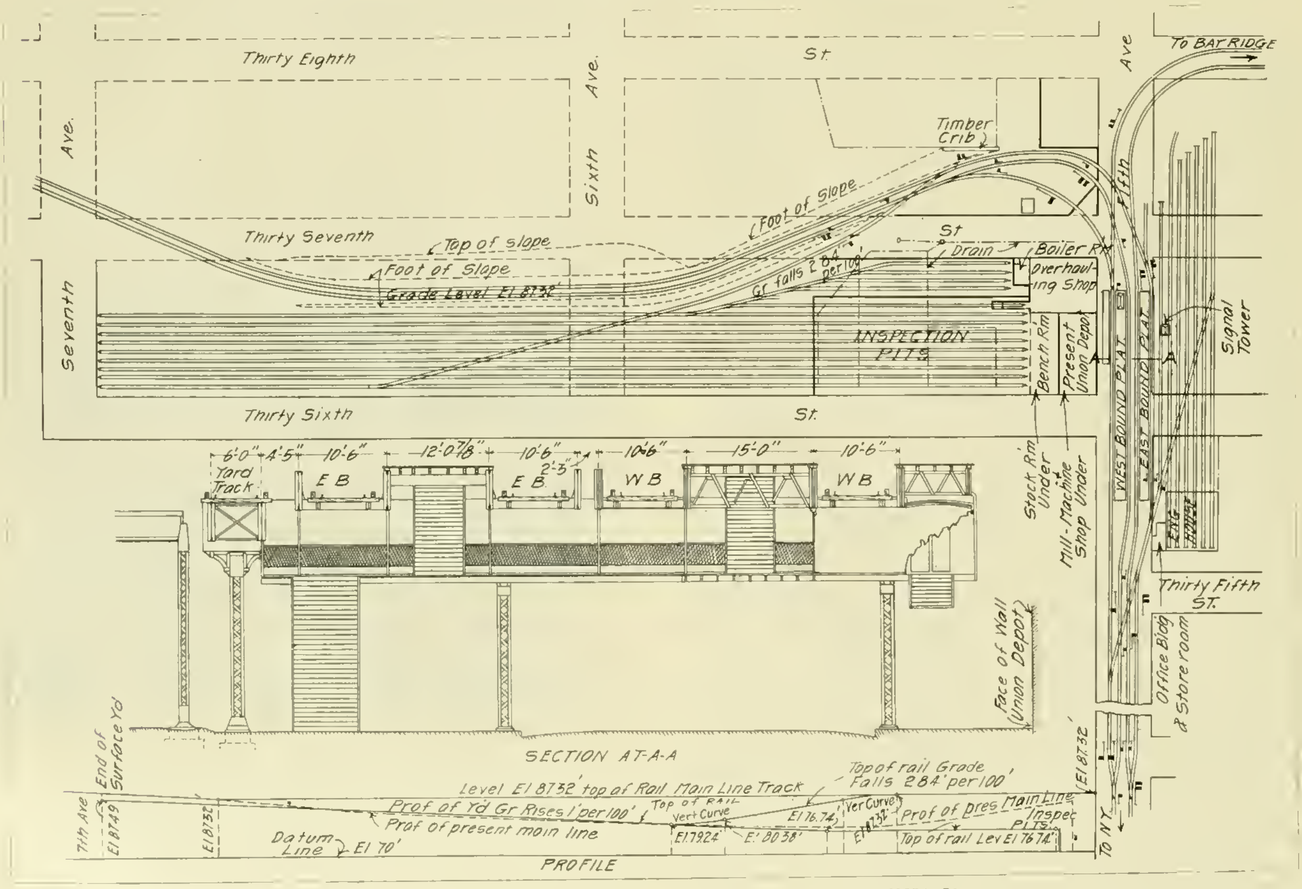
ing department delivers certain forms of the city waste to this station, which is assorted by pickers. That portion of the refuse which is of no value goes to the incinerator, the heat from which is utilized, through a system of indirect radiation, for heating the surface repair shop, the club house, the shop foreman's office, the two-story shop, the inspection shed, including the armature room, and the dispatcher's office. That portion which cannot be burned, together with the ashes from the incinerator, is taken away by the cars of the street railway.

At this point of the system is located one of the several club houses of the employes of the Brooklyn Rapid Transit Co. It is managed by the men themselves and contains every appurtenance of the modern, well-equipped club house.

reconstruction. The Coney Island tracks at one time ran into the station at right angles to the line of the elevated road, and passengers were forced to transfer. Now, however, a junction has been effected at a rather heavy, although not a difficult gradient.



EAST NEW YORK STORAGE YARDS OF THE BROOKLYN RAPID TRANSIT CO.



THIRTY-SEVENTH ST. YARDS OF THE BROOKLYN RAPID TRANSIT CO.

At Fifth Ave. and Thirty-sixth St., where the line from Coney Island joins the main Fifth Ave. route, some interesting improvements are under way. The company's business has now become so heavy at this point that the property has required almost entire

Here also a large storage yard has been built and a series of inspection pits, having space for 54 cars over the pits, and an entire reconstruction of the station is under way. At this point the difficulties arising from the false filling encountered at the East

New York improvements were not met with and the floor construction is of concrete resting on firm earth foundation. Another yard exists across Fifth Ave. at right angles to the one mentioned and the main tracks are protected at points of union with the yard tracks by a modern plant of interlocking semaphores and switches.

Improvements are also under way at the site of the Ninth Ave. depot where two new buildings are in process of construction.

FOUNDATION OF FIRE WALL IN ELEVATED YARDS.

With the insurance risk again prominently in mind, one building is being constructed in a series of double-tracked bays, separated from each other by fire walls of reinforced concrete, which rise above the roof in the form of parapets to prevent the passage of flames. There are eight of these bays, each with track capacity for 14 cars. Fire risk is further lessened by the presence of two hydrants in each bay. Concrete is also employed in the flooring. Work at this point involved the erection of an exceptionally heavy concrete retaining wall along Nineteenth and Twentieth streets, owing to the height of the street above the track level. At the street level this wall supports the roof girders of the second building, the steel structure of which rests elsewhere on concrete piers upon a solid earth foundation.

Sale of the Calumet Electric Street Railway.

After nine years of negotiations under various interests the Calumet Electric Street Ry. of Chicago has been sold to a syndicate which is headed by Messrs. Cobe & McKinnon, a firm of investment brokers in Chicago. This syndicate has purchased not only the railroad property, but all the other assets of the National Bank of Illinois which failed in December, 1896. The purchase price of the property, exclusive of cash in the receivers' hands, is about $3,150,000. On this basis the railroad property sells for approximately $3,000,000. The purchasing syndicate is composed almost entirely of local capitalists, only a small Eastern interest being represented.

The railroad is to be reorganized immediately. It is reported that Ira M. Cobe will be selected as president of the new company. Competent operating men will be retained and members of the syndicate will comprise the remainder of the official staff and the directorate. Members of the syndicate declare that they have no fixed plans as to the future disposal of the property, although they concede that there may be developments along the line of its consolidation with other traction interests. Its earnings are now rated at or about $500,000 a year, but the cost of operating is heavy. About $1,000,000 has been expended during the past five years for improvements.

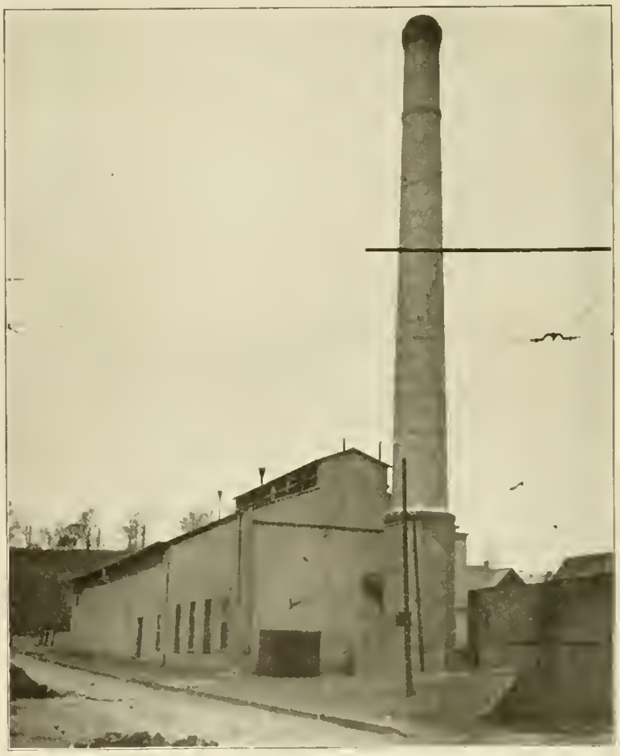
The construction of the road was started in 1890 by W. V. Jacobs, but its control successively passed into the hands of Farson, Leach & Co. and the National Bank of Illinois. It was largely a World's Fair proposition and was in operation during the time of the Fair. The property consists of 80 miles of single track electrically equipped. The company operates south of 63rd St. It owns a power house at 93rd St. and Drexel Ave. and it also owns the terminal property at 63rd St., Stoney Island Ave., and there makes connection with the South Side Elevated R. R. The rolling stock equipment consists of 240 cars.

Fire Protection for Car Barns.

BY JOSEPH B. FINNEGAN, S. B.

In an article published in the "Street Railway Review" for December, 1905, a description was given of the ordinary fire hazards to be met with in car barns, and a discussion entered into of the methods of construction of this class of property that would be most effective in minimizing the danger of starting fires and the danger of rapid destruction from a fire once started. The object of the present article is to supplement the previous one by considering fire protective measures, as distinguished from methods of construction. In this connection we must consider the installation of protective devices, and also the question of administrative methods that will result in the maximum possible advantage from these devices, as well as the minimum possibility of a fire originating from carelessness.

Nowadays, the very use of the expression "protected risks," or "improved risks" implies protection by automatic sprinklers. No other single device can compare in value with a properly arranged sprinkler system under the conditions that are found in most manufacturing or mercantile establishments. This fact is universally admitted and is recognized in a very tangible way by insurance underwriters by very large reductions in the rates of buildings equipped with this system for the immediate and automatic supply of water at the point where it is most needed. While this recognition of the value of proper automatic sprinkler systems has been given in the case of many classes of buildings, there have been certain risks which seemed to be of such nature and such occupancy that sprinkler systems would be at a decided disadvantage. Important among risks of this latter class are car barns. For the fullest measure of protection from a sprinkler installation in a risk of any kind it is essential that the protective apparatus be placed in all parts of the building so that it would be impossible for an incipient fire to be shielded from the water thrown by the sprinklers. In a



ASH STATION AND INCINERATOR.

car barn it is difficult to fulfull this condition. To a certain extent the individual cars may be considered as separate small risks, each one provided with its own roof which protects the interior from water coming from above, and at the same time, since the car roof hinders the passage of heat from the fire to the sprinklers, they will be delayed in opening. Thus, in a double sense, the sprinklers are at a disadvantage, and so serious is the disadvantage that many

have questioned the advisability of requiring their installation in car barns. This matter has been given much attention by the National Fire Protection Association during the past two years, and as a result of experiments it would seem that even under the disadvantages to be found in car barns, the automatic sprinkler has a decided value, and that by some modification of the ordinary system of installation, the use of this system of protection must materially add to the safety of the property.

Obviously, if a sprinkler installation is to be of real value, the location of the heads must be such that if a fire starts in any part of the property to be protected, the heat resulting from it must be able to reach one or more heads as quickly as possible, and the water discharged from the opened heads must be able to reach the seat of the fire with as little obstruction as possible. It is not feasible to install sprinkler heads within each car. But it is entirely practicable to locate lines of sprinklers between the lines of cars in such a way that they can discharge horizontally into the cars through the windows or transoms. During 1904 and 1905 a series of tests of sprinklers installed in this way was made in car barns at Newark, N. J., and Cleveland, O., and the results of these tests seem to warrant the belief that this arrangement, supplementing the usual ceiling system, is most desirable.

With regard to the height of aisle sprinklers, and the question as to whether they should discharge through the windows or through the transoms, it is necessary to compromise between considerations of maximum fire protection and the question of interference with the ordinary operation of the car barn. Consequently, although the sprinklers would be more effective at the window level, it would appear that such a location would be impracticable, and therefore that if aisle sprinklers are to be used, they must be installed at the height of the car transoms. It is believed that with such an arrangement there will be no serious hindrance to the proper handling of the cars.

The distribution of water from an aisle sprinkler should be as nearly horizontal as possible, and consequently a form of deflector is required that differs from those in ordinary use for ceiling sprinklers. Moreover, each aisle sprinkler should be provided with a hood so arranged that the head can not be chilled and rendered inoperative by the spray from a ceiling sprinkler above it which may have opened first.

As for the ceiling sprinklers, if the building is of any considerable height it may be advisable to hasten their operation by means of a series of curtain boards of combustible material extending downward from the roof in such a way as to divide the area into pockets.

In all the northern states it would be unwise to use the so-called "wet systems" of sprinkler installation in such a large unheated building as a car barn, as the winter temperature is low enough to disable the system by freezing the water in the pipes and bursting the piping. Consequently, recourse is had to the "dry system," which is so arranged that the pipes within the building ordinarily contain air under pressure. When a sprinkler head opens, the air pressure is relieved and water is admitted to the system by the tripping of an automatic dry valve that controls the supply.

No amount of care and expense in the arrangement of sprinkler piping and sprinkler heads can be of value unless the supply of water to the system is ample and under considerable pressure. Moreover, in order that the supply may be altogether reliable, connection should be made to at least two independent sources. Connection to city mains is acceptable if the pressure obtainable is at all times adequate, that is, if it can be depended upon to give a static pressure of at least 25 lb. per sq. in. at the level of the highest line of sprinklers. A system of fire pumps, of either the steam or electric type may be used. As a substitute, or in addition to the sources mentioned, recourse may be had to a gravity tank properly elevated on a trestle of sufficient height to give the required head of water; or pressure tanks may be installed.

Among the mechanical devices that are useful from a protective standpoint, probably the automatic alarm ranks next in value to the sprinkler equipment. The alarm may be arranged as an adjunct to the sprinkler system, so that the operation of the system will give a signal, or it may depend upon a system of thermostats properly placed throughout the building. The operation of the alarm system should give a loud signal on a gong on the premises, and also should transmit the alarm to the residence or office of the official in charge, to the municipal fire department headquarters, or to the office of one of the several companies that devote themselves to fire alarm service.

Because a car barn is equipped with an automatic sprinkler system and a good alarm system, it is not justifiable to neglect the use of the commoner and simpler fire extinguishing devices. It is desirable that an efficient standpipe system be installed, having ample water supply, and with all piping of adequate size. Hose outlets with gate valves should be installed at suitable places, and to each of these connections should be attached 50 or 100 ft. of fire hose, with a nozzle. Moreover, the building should have a complete equipment of ordinary fire pails and casks and a supply of small chemical fire extinguishers of the sulphuric acid and bi-carbonate of soda type. Pails of sand are to be recommended in any parts of the building where oils are stored or handled.

In order that the various protective devices may be used intelligently, it is desirable that a private fire brigade be organized. This is really not a difficult matter to accomplish, and the results obtained by a little care in this direction will amply repay the company in increased efficiency in the use of the apparatus that has been installed. The chief of the brigade should be some one high in authority in the ordinary operation of the car barn. His duties will be to drill the brigade and take direct charge in case of fire. The night foreman should be appointed deputy chief, with full power to assume the duties of the chief in case of fire starting at night when the latter is off duty. Two standpipe men should be on duty in each shift, their instructions being to use the nearest hose to fight the fire. Three men should be designated to use chemical extinguishers and fire pails as soon as a fire is discovered. Three car men should be appointed, their duty being to get controller and brake handles and begin to run cars out of the barn. If the fire is a small one, the cars nearest the fire should be run out first; if the fire promises to be serious an attempt should be made to run out the most valuable cars, so far as this is possible. All the other men on the premises are to be subject to the orders of the chief and perform such duties as he may direct, as axe-men or as assistants to the men whose duties have already been mentioned. In practically every case it will be possible to have on duty at all times at least five men of the regular brigade. To facilitate the work of the firemen, controller and brake handles should be distributed in suitable places, with conspicuous signs and colored lights to call attention to them. Several sets should be placed near the entrance to the barn. At this point also several axes should be placed in racks so as to be readily accessible. Spanners should be placed at all the hose connections in the standpipe system, and the standpipes themselves should be indicated by colored lights.

In order that small fires or dangerous conditions that might result in fires may be immediately discovered, it is essential that an efficient watchman service should be maintained. A watchman should make his rounds every hour at night and every two hours during the day, recording his trips by means of an approved watchman's clock. His stations should be so located that he must visit every part of the building. The records should be examined daily and kept on file.

Finally, a thoroughly competent inspector should be appointed, whose duty should be to make to the office of the company a monthly report giving detailed information as to the condition of the property.

In conclusion it may be said that the prevailing hazardous conditions and high insurance rates of street railway property can be done away with only by careful and conscientious attention to construction, equipment, and administration. Years ago a cotton mill was considered to be such an extremely hazardous risk that the rates on such property were almost prohibitive. Modern methods of building, protection, and maintenance have resulted in making cotton mills most desirable risks. What has been done in this case can be done in the case of property of street railway companies.

In the April issue of "Lippincott's Magazine" appears the story of a spirited contest for a railroad right of way. This clever novelette, written by Samuel Merwin, is entitled "The Battle of the Fools."

The earnings of the Massachusetts Electric Companies for the quarter ending March 31st, show a very substantial improvement, and are the best figures yet reported for the first quarter of the calendar year in the history of the company.

Piping and Power Station Systems.—XVIII.

BY WILLIAM L. MORRIS, M. E.

If the high-pressure side of an engine is to have reliefs piped from it, the piping should be done in the manner illustrated in Fig. 157. The reliefs should discharge into the high-pressure exhaust, in which case there should be used a flanged side-opening return bend, as shown by the dotted lines, to which the pipe bends may be attached. The piped relief is objectionable because it allows the relief to be neglected and to waste steam in the most expensive manner. Engine builders in general, prefer to have the valve left open, their reason being that if everything is as it should be, the valve will

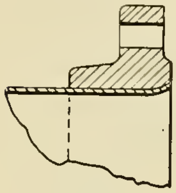


FIG. 158-(C1-1).

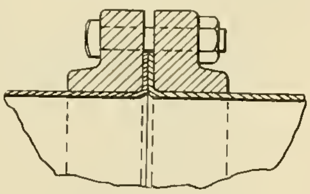


FIG. 159-(C1-2).

not blow. If these connections are to be used, the engine builder should be required to furnish them.

ATMOSPHERIC EXHAUST.

Main and Branches to Engines and Atmosphere.

The exhaust main and its branches which connect the exhaust ports of the engines in a non-condensing plant with the atmosphere, are constructed with details similar to those of a vacuum exhaust line. The various parts of atmospheric exhaust systems may be made sufficiently tight with somewhat less effort than is necessary for condenser connections. In atmospheric exhaust piping spiral-riveted, light-galvanized iron pipe is found quite satisfactory. If the pressure on the exhaust line is kept at about the atmospheric point, the light valves and fittings, sometimes called the "50-lb. standard," may safely be used. The connections may be made with rubber-cloth gaskets. If the piping is of the riveted type it should be well galvanized after the flanges are put on. This galvanizing serves to close any leaks and tends to hold the joints together even if the rivets become loosened. The use of tarred or other paper in joints should not be sanctioned on account of the bad effects that may be caused by oil in the exhaust steam. The tendency of boilermakers to make use of some elastic material such as tarred paper in riveted seams, apparently shows that it is an expensive job to make tight seams in piping having a shell but ⅛ or 3/16 in. thick. The use of thin punched, rolled and riveted galvanized plates should be avoided, as better joints can be made with riveted and caulked back plates. If the main is sufficiently large to admit of the use of a quarter-inch plate, it then becomes a simpler matter to caulk the back plate than to galvanize it.

For small pipes, six inches or less, the difference in cost between light-weight, commercial, lap-welded pipe and riveted pipe is too small to be worth considering.

For a very high grade of work the light "casing" or tubing attached to the flange in the manner shown in Fig. 158-(C1-1) will be found quite satisfactory. The flange as shown in this illustration can be attached in the field and the light-welded pipe may have a maximum diameter of 30 in. The end of the pipe should project slightly beyond the face of the flange in order that the joint may be made at the end of the pipe. The flange should be shrunk on and the pipe well peened into the heavier metal.

There is another style of connection shown in Fig. 159-(C1-2) which makes a very satisfactory flange, but owing to the great amount of "drawing out" of the metal used in making the flange, the connection should be made at the shop where there are special facilities for doing this work. The flanges used in this joint are made large enough to be loose on the pipe in order that they may be used to draw the flanged ends together. In Fig. 159 the flanges are made of cast iron, but for peened work as in Fig. 158 the flanges should be made of wrought iron, rolled steel or steel casting. For light casing pipe a cheaper form of construction is found in the use of fine casing thread-ends and screwed flanges. Such threads on a 12-in. casing should have the standard pitch of 11½ threads to the inch.

Atmospheric exhaust lines up to 24 in. in diameter should be made of metal with a thickness of not less than 1-100 in. per inch of diameter. Exhaust lines 10 in. in diameter have been made of No. 20 galanized iron. Since the exhaust from an engine is intermittent and the pipe a condensing body, the vacuum in such a light pipe will cause it to collapse even though the end be open to the atmosphere. An atmospheric line should be designed as if it carried about five inches of vacuum. Cast-iron ells and tees should be used on exhaust lines of 30 in. and less, but for larger vacuum exhaust mains the ells and tees can be made of riveted plates with the flanges placed as shown in Fig. 159. A diameter of 30 in. is virtually the dividing point between pipe-shop and boiler-shop work. Vacuum exhaust mains 30 in. or less in diameter can be made of welded pipe with screwed flanges and cast fittings. If the size is larger than 30 in. the pipe thickness becomes sufficient to make good caulked work possible. The fittings of a five-foot line should be made extremely heavy and short radius bends should be used to reduce the weight.

Fig. 160-(C1-3) shows a 5 x 3 x 4 ft. tee made up of plate metal and loose cast-iron flanges as shown in Fig. 159, with tension or compression posts (marked a) to strengthen the flat faces. This tee as shown has turns of large radius and is of a size which would be quite out of the question for a cast fitting. There are about 12 sq. ft. of flat face on each side of the tee which must resist the atmospheric pressure at 15 lb. per sq. in. This is a total of about 26,000 lb. pressure or 3,700 lb. for each of the seven posts. These

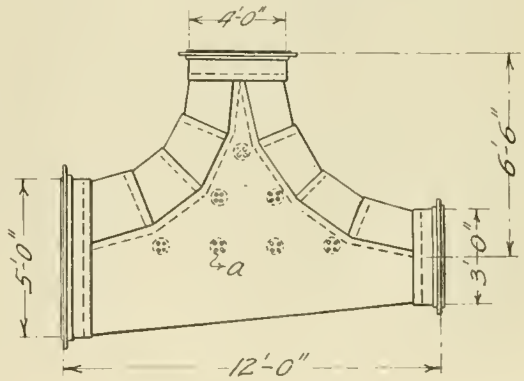


FIG. 160-(C1-3).

posts should be of pipe and have steel flanges at the ends riveted to the shell.

As exhaust lines are of a light type of construction it is necessary that they be well protected against water pockets and water hammer. The drains should be in the same direction as the flow of the steam and there should be some sort of a water seal as shown in Fig. 161-(C1-4). In Fig. 161 the distance, a, should be made sufficiently great to prevent the pulsating pressure from churning the water out of the seal. While the gage may show but little

back pressure, the exhaust may still be blowing through if there is a short water seal at a. Twenty-seven inches of still water will provide an effective seal against a back pressure of one pound, but in actual practice such a short seal will not be effective if the engine is running. To have the seal operative under all working conditions, the distance a, should not be less than five or six feet. The casing pipe should not be less than four inches in diameter and a loose cap should cover the top of the well to facilitate the removal of the drain pipe. The drain to the sewer should be left open so that an operator may, by inspection, know what is passing away through the drain.

If the exhaust pipe is not less than three feet above the floor the seal may be made of elbows and valves as shown in Fig. 162-(C1-5). In case of a considerable back pressure with this arrangement of piping the upper portion of the loop may be used. The closing of valve a, will make the loop about five feet high, if its top is placed two feet above the bottom of the exhaust main. By placing a check valve at b, the surging can be stopped and a shorter seal used.

The atmospheric connection from condensing engines should in all cases be provided with a sealed drain and an exhaust head should also be provided with a drain and a short seal. For non-condensing engines the atmospheric pipe may be run to the atmosphere without an exhaust head. A simple form of exhaust head which will be found more serviceable than one made of galvanized iron is shown

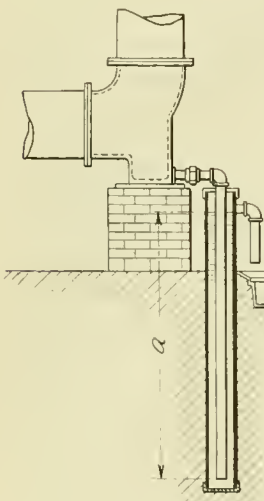


FIG. 161-(C1-4).

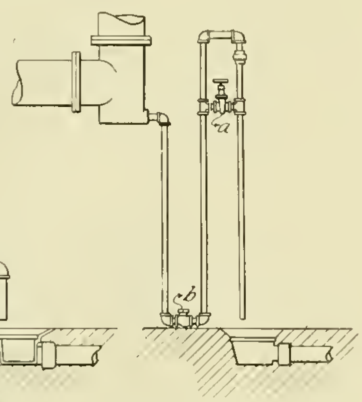


FIG. 162-(C1-5).

in Fig. 163-(C1-6). This form is suitable for use on condensing work. The spiral, a, throws the condensation to the side of the pipe and the lip, b, overlaps the face of the upper portion of the head, c. This allows the water to be carried into the annual recess, d, and conducted to the sewer through the pipe, e. The entire upper portion of the head is made of cast iron and is heavier and more durable than the pipe itself.

Where the exhaust and drain pipes pass through the building roof there should be provided a roof sleeve and an umbrella which will care for the expansion and contraction of the pipe and at the same time will prevent leakage at the roof. Fig. 164-(C1-7) shows a roof sleeve made of heavy galvanized iron with a thimble, a, through which the drain from the exhaust head passes. The diameter, b, of the roof sleeve should be made large enough to allow the sleeve to fit into the flange at the end of the pipe. The umbrella should be made in two pieces with each piece attached to a half clamp. At least three ply of paper should be laid on the roof and the roof plate of the sleeve should be well tacked down upon it. After erection, the roof plate should be mopped and at least three ply of paper placed over it. Such gravel as is used on the remainder of the roof should then be placed over the plate and the roof cement run into the joint c, and up the side of the sleeve to protect it against the weather. After the umbrella has been well secured to the pipe the joint, d, may be filled with lead to prevent leakage. The thimble, a, should fit the pipe closely and what little leakage occurs at the joint ordinarily will not cause any trouble. If necessary, a coupling with the umbrella soldered to it may be placed immediately above the sleeve as indicated by the dotted lines. Stays such as are shown at e, should be attached to the roof sheathing to prevent the pipe from swaying sideways and damaging the light roof sleeve or umbrella. There should be nothing to interfere with the free expansion of the pipes running through the roof and if the building is very high the umbrella should be made with a deep drop flange to suit the amount of travel caused by expansion, which for an exhaust line varying in temperature from 32° to 212°, would be about 1¼ in. per 100 ft.

Auxiliary Exhaust Main and Relief to Atmosphere.

In a condensing plant an auxiliary main should be used for the auxiliary machinery. Ordinarily this main would be designed to take care of less than one-sixth of the total steam generated. Its area would be about one-sixth of that of all the exhaust steam openings including those of the auxil-

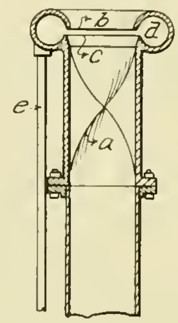


FIG. 163-(C1-6).

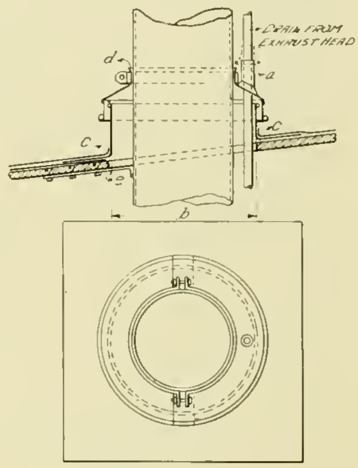


FIG. 164-(C1-7).

iaries. Such a main in a plant having four 1,500-kw. units would have an area equal to that of four 24-in. main exhausts and the auxiliaries. This would be about 2,000 sq. in. Since one-sixth of this area is 333 sq. in. a 20-in. pipe would be required. If most of the larger auxiliaries are electrically driven the exhaust may be of such a small amount that if the water be taken from the hot-well at 100° the exhaust will not raise its temperature higher than 170°. With motor-driven auxiliaries but one-fifteenth of the steam generated would be returned to the heater and the cross-sectional area of the pipe would need to be but one-fifteenth of 2,000 sq. in., or 133 sq. in. Thus a pipe with not less than a 14-in. diameter would be required. This size is more often used for such service.

Since the auxiliary exhaust is used in connection with auxiliary machines and will have small branches, it may be found more economical to use standard pipe, screwed flanges and cast-iron fittings

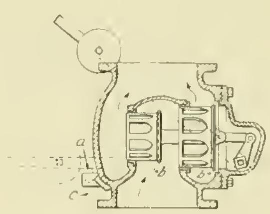


FIG. 165-(C4-1).

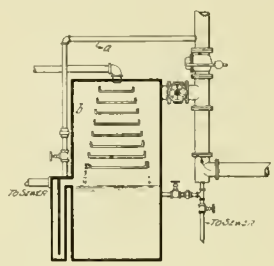


FIG. 166-(C6-1).

throughout. To avoid the entrance of drips, the branches to the auxiliaries should enter near the bottom of the main, and the main should have a slight pitch towards the heater. The pitch, however, is not absolutely essential, as the flow of steam towards the heater will carry the drips with it. It is often difficult to make suitable provision for an auxiliary exhaust system and therefore it should be given careful consideration before floor levels and similar details are determined upon. Care should be taken in designing so that the exhaust will drain to the heater and the heater be placed sufficiently high to enable the water to flow to the feed pump suction by gravity.

As it will be necessary when cleaning the heater to discharge all exhaust steam through the atmospheric connection, the atmos-

pheric connection from the auxiliary main should have the same capacity as the main itself. The amount of steam wasted to the atmosphere in such a short time would be so small that it would neither pay to install a reserve heater nor make any double connections to allow for the running of the auxiliaries under vacuum. An atmospheric connection also serves as a safety-valve line on the exhaust system to prevent the pressure from exceeding some predetermined amount. The type of valve that should be used in an atmospheric connection should be designed for such service and no other. In fact, if there is more steam supplied to the heater than can be condensed, a back-pressure valve should not have a seat, but

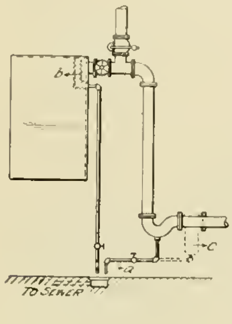


FIG. 167-(C6-2).

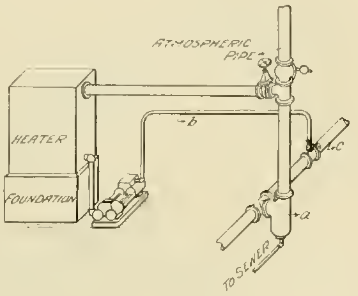


FIG. 168-(C6-3).

should serve as a resistance in the line, maintaining a fixed pressure and allowing the excess steam to waste to the atmosphere.

Fig. 165-(C4-1) shows a good form of noiseless back-pressure valve. The piston has toothed edges, which decrease the resistance to the flow as the steam is admitted through the port opening. The cushion, a, serves to lessen the jar on the valve when the lever drops. There are no seats for the valve to pound upon and since the piston slides its action is noiseless. Although the piston does not close tightly the leakage past the valve is very slight. This valve is well suited for exhaust systems carrying a back pressure and in which the quantity of exhaust supplied to the heater is ordinarily greater than can be condensed.

For a heater which is being supplied with an insufficient amount of steam to raise the temperature of the water, it would be advisable to use a valve of this form with seats to close upon. Such seating faces are shown by the dotted lines at b. This type of valve will close sufficiently tight for the purpose just described. Owing to the fact that the valve leaves its faces when steam is discharging through the serrated portions of the piston, this valve will be free from any great amount of pounding. The atmospheric pipes should be provided with a roof sleeve and an umbrella similar to those used for the pipes from the engines. The drain, c, should be piped to the sewer, as it is not possible to lead the drips back through the valve if the pressure is slightly above atmosphere. This drain may connect with the drain from the exhaust head.

Exhaust Branch to Heater.

If possible, the exhaust branch to the heater should drain from the exhaust main into the heater. If the bottom of the exhaust main is above the overflow of the heater, the detail shown in Fig. 166-(C6-1) will take care of the drains and allow steam to enter at the top. This will be a desirable arrangement if the heater is able to condense all of the steam fed to it. The pipe, a, serves a double purpose, as it allows air to either enter or be discharged from the heater. Since the arrangement shown in Fig. 166 is for a condensing plant the amount of water sent to the heater, when an air pump is used, would ordinarily maintain a vacuum of 16 or 18 in. To allow the water to flow to the pump suction it would be necessary to raise the heater one foot for each inch of vacuum carried. If the pipe, a, is open any increased amount of steam or a decreased amount of water, will cause the air to be partially discharged until the condensing surface is just sufficient to condense steam at atmospheric pressure. As soon as the amount of water is increased or the amount of steam diminished the air will rush back into the

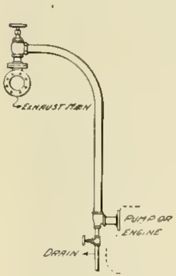


FIG. 169-(C7-1).

heater. The line, a, automatically cuts the condensing surface in or out. Instead of discharging the steam through the atmospheric valve when there is too much air in the heater the air alone is discharged from the heater and no steam is wasted in the process.

If the exhaust main is much lower than the heater this main can be drained with an entrainer as shown in Fig. 167—(C6-2). This

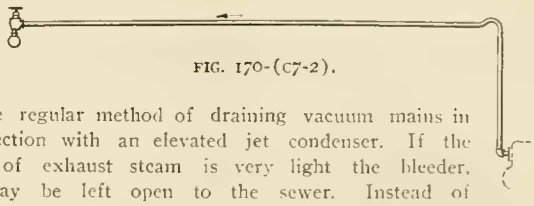


FIG. 170-(C7-2).

is the regular method of draining vacuum mains in connection with an elevated jet condenser. If the flow of exhaust steam is very light the bleeder, a, may be left open to the sewer. Instead of placing the grease extractor at the heater opening as indicated by b, it would be advisable to locate it at a lower point, c, and allow the grease extractor to handle both the entrained oil and water. If this practice is followed there will be no other drain required. The exhaust branch connecting the separator with the heater should drain either to the heater or to the separator. If the auxiliaries are placed close to the heater their exhaust should be run back and discharged at the head of the separator as shown in Fig. 168-(C6-3). In this figure the grease extractor is shown at a. The exhaust from an auxiliary is carried by the pipe, b, to the exhaust main, c. The drain from the grease extractor should be run to the sewer, as the water contains too much grease to make it advisable to return it to the boiler.

Exhaust Connection to Auxiliary Machines.

The connection shown in Fig. 169-(C7-1) is considered standard for all the auxiliary machines in the classes from C7 to C17. If the exhaust main is 2½ in. or more in diameter it should be fitted with

FIG. 171-(C7-3).

flanged tees even though the side outlets are as small as 1½ in. If the branches are 2½ in. or larger the stop valve should be flanged and connected directly to the tee, using, if desired, a screwed drip ell at the bottom with the flange connected to the pump. The drains for the exhaust branches should be made of not less than ⅜-in. pipe. The connection shown in Fig. 169 allows a swing in both a vertical and horizontal plane. If the auxiliary branch is made of 4-in. pipe the net cost of a 4-in. flanged angle valve would approximate $6.35 and the combined cost of a 4-in. flanged elbow and gate with an extra joint, $8.10, or a difference in favor of the angle valve of $1.75.

Cost should be the deciding factor in the design of pipe work where the advantage to be gained by the use of more expensive detail is not positively known. This statement is well illustrated by the difference in price of the angle valve as compared with the gate and elbow. The advantage of the one form over the other is very slight and since there is an appreciable difference in cost it is, of course, better practice to use the cheaper detail.

The arrangement of the exhaust branches is quite simple. First, the drain should be placed at the lowest

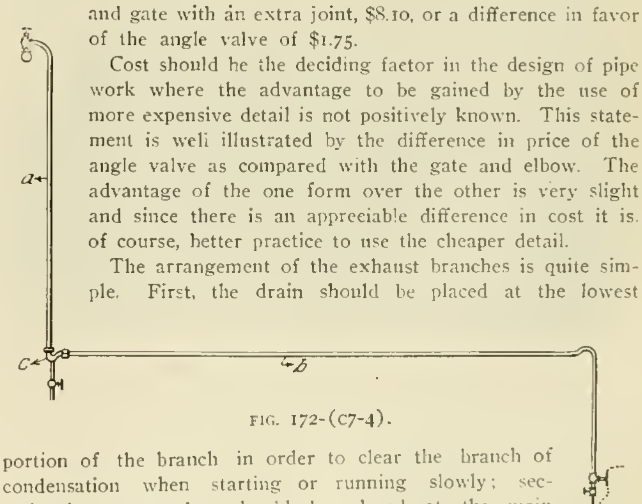


FIG. 172-(C7-4).

portion of the branch in order to clear the branch of condensation when starting or running slowly; second, the stop valve should be placed at the main to enable the branch to be repaired without interfering with the main, and also to prevent the branch from filling with condensation when shut off; third, the branch should enter the main above the bottom and preferably at the top; fourth, long branches should rise to their highest point at the auxiliary and should then be given a pitch for the remainder of the distance to the exhaust main, although this requirement is frequently a difficult one to fulfill.

Fig. 170-(C7-2) illustrates a long branch running to the main in the most approved manner. The horizontal connection should have a slight pitch towards the main in order to avoid pockets where the line sags.

Fig. 171-(C7-3) shows a line with a considerable pitch which in reality is an "up-hill" line before discharging into the main. A line supported in such a manner that it is level throughout would serve quite as well and would make the pipe fitting a much simpler matter. The machinery that lies in basements, etc., is generally difficult to keep properly drained without resorting to drains to the sewer.

Fig. 172-(C7-4) shows such a line as has just been mentioned with sewer drains that can be closed as soon as the steam unit is in operation. To reduce the length of the "lift" to the least amount possible, the riser, a, should be placed close to the exhaust main. The line b, should have a fall through the entire distance to the entrainer, c. These entrainers are standard articles, being listed by the manufacturers as a "drainage fitting" and are made in different sizes of from 2 to 8 in.

(To be continued.)

New Car Houses of the York Street Railway Co.

Like many other companies operating extensive city and interurban street railway properties, the York Street Railway Co., York, Pa., is working out a plan that will permit the storage of all its cars and the consolidation of all repair work on one property. With this idea in view, the company planned, some time ago, the construction of three modern brick buildings on property owned by it in the outskirts of York. These buildings will replace the frame structures earlier occupied.

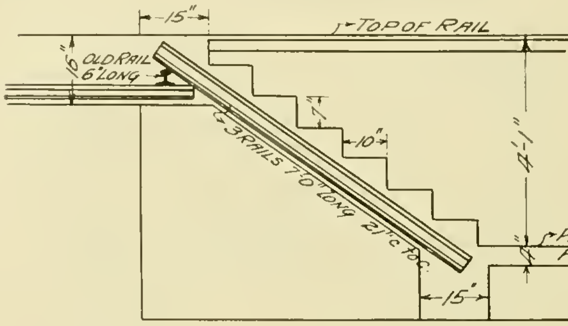
Several months ago a machine and heavy repair shop of brick and concrete construction, occupying a ground floor space of 50x 230 ft. was completed. In this building, which is the first unit of the general scheme, all necessary lathes, wheel presses, and drills needed in the general repair work are located near the pits. The repair shop fronts on the street, making it possible to switch cars, brought in for repairs, from the main line direct to the repair barn without passing over the tracks leading to the other buildings.

The second unit of the shop group is located at the rear and to one side of the repair shop. This building is 60 x 238 ft. in floor area, and is designed to be used for car storage and light repair work. The third unit, which will be patterned after the design of the other two, is to be built immediately at the rear of the repair shop facing the storage barn. In this building the paint and carpenter shops and other departments not provided for in the two completed units will be located.

NEW CAR HOUSE OF THE YORK STREET RAILWAY CO.

An interesting feature in the track and floor construction of the buildings is the provision made for handling the cars in case of fire. All tracks are laid with a one per cent slope toward the street. To increase the efficiency of the scheme, the ladder arrangement of switches has been used in the special track work between the street and the buildings. With this arrangement no transfer tables are needed, and it is believed that no trouble will be experienced in quickly running the cars to a point of safety in case of accidental fire. When this scheme of graded tracks is completed, a car set in motion at any point on the company's property will by its own weight be carried to a point on the street a safe distance from the buildings.

The roof of the storage barn which is shown in the accompanying illustration, is constructed of trusses built of 8 x 10-in. timbers sheathed with 2-in. hard pine plank and having a covering of slag. This building is well lighted by day by large double windows in the end and side walls, and as it is to be used for night inspection work, much care has been given to the arrangement of its electric lights. Two arc lamps have been placed over each aisle between the pits. In order to further facilitate night inspection, incandescent lamps have been placed along the interior of the pits and 7 ft. 6 in. apart. These lights are placed in niches in the concrete walls, deep enough to allow them to stand inside of the surface line of the pit walls and safe from injury. This arrangement of pit lights was adopted after recommendations made at the convention of the American Street & Interurban Railway Association at Philadelphia.



REINFORCED CONCRETE STAIRWAY AT THE END OF REPAIR PITS.

The lighting wires are carried to wall switches located in the front part of the building and are so arranged that current can be turned on or off any of the pits or arc lights as desired.

Five tracks enter the building. The rails are laid in concrete and are tied together by steel rods. The pits are of standard concrete construction. A space 60 ft. long in the front part of the building is reserved from the pits for washing cars or doing such light repair work as may be necessary. Drain openings located at suitable points on the main floor and in the pits, lead to a sewer which carries off the refuse matter. Adequate fire protection is provided from a city water main. Three and one-half-inch taps and the necessary coils of hose are located at convenient points about the building and as an added precaution a large number of fire buckets, which are kept in racks, are distributed at intervals about the building.

The syndicate which recently purchased the York Street Railway Co. and its affiliated lines has reorganized and is planning a number of additions and improvements. The system has been developed from time to time and its lines have been extended until they now parallel the Northern Central, the Pennsylvania and the Western Maryland railroads for some distance from the city.

The officers of the York Street Railway Co. are: W. F. B. Stewart, president; A. H. Hayward, vice-president; and David Young, Jr., general manager. The directors include Grier Hersh, Baltimore, W. F. B. Stewart, York, A. H. Hayward, York, David Young, New York, George H. Frazier, Philadelphia, and Thomas Newhall, Philadelphia.

Grier Hersh, who was elected president at an earlier meeting of the stockholders, was obliged to decline the honor because of other pressing business interests. David Young, Jr., the new general manager, is a son of David Young, who is a director in the company.

Mr. J. W. Butler, passenger agent of the Cleveland, Painesville & Eastern Railroad Co., is issuing an attractively illustrated folder descriptive of the company's Willow Beach Park.

The New Orleans Railway & Light Co. has recently issued a very pleasing little booklet in which are presented a number of views of the electrical illumination of the city of New Orleans during the carnival of the Mardi Gras, held on Feb. 27, 1906.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Kenfield Publishing Co. under the title "Street Railway Law," five volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901 to 1903; Vol. V. from April, 1903, to August, 1905. Price: Bound in sheep; five volumes, $12.00; single volume, $3.00. Bound in buckram; five volumes, $8.00; single volume, $2.00.]

DAMAGES IN PERSONAL INJURY CASES NOT MITIGATED BY INSURANCE.

Corish vs. North Jersey Street Railway Co. (N. J. Sup.), 62 Atl. Rep. 1004. Feb. 26, 1906.

In actions for personal injuries damages are not mitigated, the supreme court of New Jersey holds, by insurance paid to the plaintiff under a contract to which the tort-feasor (wrong-doer) was a stranger.

PRESUMPTION OF NEGLIGENCE WHERE INJURY TO PASSENGER IS CAUSED BY DEFECT IN MEANS OF TRANSPORTATION — BROKEN BRAKE CHAIN — PROOF OF BRAKES HOLDING ON PREVIOUS TRIP.

Dougherty vs. Pittsburg Railways Co. (Pa.), 62 Atl. Rep. 926. Jan. 2, 1906.

Where injury to a passenger is caused by a defect in the means of transportation, the supreme court of Pennsylvania says that there is a presumption of negligence on the part of the carrier. The plaintiff in this case was a passenger in one of the defendant's cars, and the accident in which she was injured was caused by the failure of the brakes to work because of a broken chain. It was not shown what caused the chain to break, nor what its condition was before the accident. The only proof by the defendant was that the brake held the car on the previous trip. This did not rebut the presumption.

ORDINANCE HELD TO REQUIRE PARTICIPATION IN COST OF IMPROVEMENTS ON ALL STREETS TRAVERSED.

City of McKeesport vs. Pittsburg, McKeesport & Connellsville Railway Co. (Pa.), 62 Atl. Rep. 1075. Jan. 2, 1906.

By a city ordinance a company, for the purpose of extending its lines, was granted permission to use and occupy with its tracks certain additional streets. After requiring the company to repave all improved streets and leave in good condition all unimproved streets "occupied under this ordinance," the ordinance further provided, in another separate and distinct clause, that: "On all highways traversed by said company, which shall hereafter be improved, said company shall pay the cost of the improvement between its tracks and lines of tracks and one foot on each side thereof." The supreme court of Pennsylvania holds that this imposed the duty upon the company of paying this proportion of the cost of improving all highways upon which its tracks were laid.

LIABILITY FOR INJURY FROM LOOSENING OF NUT HOLDING FENDER—JURY NOT BOUND TO ACCEPT AS SUFFICIENT EVIDENCE OF SYSTEM OF INSPECTION.

Winter vs. Interurban Street Railway Co. (N. Y. Sup.), 96 N. Y. Supp. 1009. Dec. 21, 1905.

The plaintiff, when standing on the rear platform of defendant's street car, was struck by the brake handle and injured; the motion of the brake handle having been caused by the rebound of the rear fender of the car, which had fallen to the street through the dislodgment of a nut whereby it had been attached to the car. The appellate term of the supreme court of New York says that it was competent for the jury to find that the loosening of this nut was the proximate cause of the injury, and, since the nut had a necessary purpose in holding the equipment of the car together, the fact that it became loose and failed of its purpose justified an inference that it had not been properly secured in place—an omission which touched the defendant in its duty of care towards its passengers, since an insecure condition of the fender, with the car in motion, was reasonably to be deemed dangerous to passengers on the platform Within the rules applicable to cases of this kind, therefore, a cause of action was apparent, and the proof warranted a recovery unless the jury should accept as sufficient the defendant's evidence of its system of inspection, which they were not bound to do.

LABORER RIDING ON PASS NOT FELLOW SERVANT WITH MOTORMAN, BUT A PASSENGER—ONE CAR RUNNING INTO ANOTHER EVIDENCE OF NEGLIGENCE—LEAVING LOOSE LEAVES ON TRACK MAKING IT SLIPPERY.

Haas vs. St. Louis & Suburban Railway Co. (Mo. App.), 90 S. W. Rep. 1155. April 4, 1905.

A laborer on the defendant's tracks was ordered to go to a certain point, having a laborer's free pass therefor. As he got upon the rear platform of a car, however, it was run or bumped into by another car, throwing him off. The St. Louis court of appeals holds that he was not a fellow servant of the motorman. Being wholly disconnected in his employment with the operation of the cars, his relation to the defendant was that of a passenger, to whom it owed the same degree of care as to any other passenger. In respect to the proof of negligence, the fact that one of the defendant's cars was allowed to run into the one on which the plaintiff was a passenger was prima facie proof that the defendant was negligent. And the court thinks that the evidence of the motorman, to the effect that he was unable to control the car on account of the slippery condition of the track, caused by loose leaves that had fallen upon it and had been suffered to remain there, showed negligence on the part of the defendant in failing to keep its track in a reasonably safe condition for the operation of its cars.

CHILD OF AGE FOR WHICH NO FARE IS CHARGED AS PASSENGER—STOPPING SUDDENLY, THROWING CHILD FROM SEAT.

Ball vs. Mobile Light & Railroad Co. (Ala.), 39 So. Rep. 584. Nov. 15, 1905.

The plaintiff's evidence showed that he was a child under four years of age, and at the time of the alleged accident was riding on the defendant's street railway car, accompanied by his mother, who had paid her fare as a passenger on said car. No fare had been paid for the child, and in this connection it was competent, the supreme court of Alabama says, for the plaintiff to show a general custom on the part of the defendant not to charge fare for the carriage of children of the plaintiff's age. And under such circumstances the court thinks there can be no doubt of the existence of the relationship of passenger and carrier between the child and the defendant. Furthermore, the court says that in this case there was evidence tending to show that the plaintiff was a passenger, irrespective of proof of a custom above adverted to. One witness testified that "there were about seven or eight passengers on the car, and this little boy, Freddie Ball, was one of the passengers." With this testimony in, the question of passenger vel non (or not) was a question for the jury. Again, the court says that there was evidence tending to show that the car was stopped with unusual suddenness and a jerk, and by the sudden stopping of the car the child was thrown from the seat and injured. On this evidence the question

of negligence in the manner of stopping the car by the defendant's servant was one for the determination of the jury, and the court could not say as a matter of law that the defendant's servant was not guilty of negligence.

GIVING OF TRANSFERS SHOULD NOT BE COMPELLED BY MANDAMUS WHEN THE DUTY IS CONTRACTUAL ONLY.

Mayor, Etc., of City of Newark vs. North Jersey Street Railway Co. (N. J. Sup.), 62 Atl. Rep. 1003. Feb. 20, 1906.

A writ of mandamus, the supreme court of New Jersey holds, should not issue at the instance of a municipal corporation to compel a street railway company to give transfers to its passengers within the municipality, when the obligation of the company to do so arises wholly from its assent to certain municipal ordinances which, of themselves, have no legislative force. For example, the court says that the claim of the city in this case was based upon its construction of the municipal ordinances. The court has not been able to find that these ordinances possessed any legislative force with regard to the matter in dispute, namely, the fare which the company might collect for transportation. Their efficacy was derived wholly from the assent of the company thereto, given as a condition on which certain privileges were granted by the city. These ordinances and the assent constituted a contract. The benefits of this contract were to be enjoyed, not by the city in its corporate capacity, but by the individual passenger within the city limits. The rights thus created were essentially private, and their denial might be made the subject of a private action. Mandamus is not the appropriate remedy for enforcing private rights growing out of contract.

NO LIEN CAN BE CREATED ON RIGHT OF ACTION FOR PERSONAL INJURY—SUCH RIGHT OF ACTION NOT ASSIGNABLE — SETTLEMENT WITHOUT KNOWLEDGE OR CONSENT OF ATTORNEY.

Boogren vs. St Paul City Railway Co. (Minn.), 106 N. W. Rep. 104. Jan. 5, 1906.

A lien, the supreme court of Minnesota holds, cannot be created upon a mere right of action for personal tort.

A right to recover damages for a personal tort is a mere personal right, and not assignable before judgment.

Here B., claiming to have a right of action against the railway company for damages for personal injuries, made a written contract with G., an attorney at law, by which G. agreed to bring the action and to pay all expenses of the suit, and B. agreed to pay G., after the expenses had been paid, 50 per cent of all money received from the railway company as compensation for his injuries. The action was brought, and after a disagreement of the jury, while the case was on the calendar awaiting another trial, the plaintiff and defendant, without the consent or knowledge of G., settled the case. On a petition by G. for leave to proceed in the case to protect his interests, the court holds: (1) That G. had no lien upon the cause of action and was not the equitable assignee of an interest therein. (2) That the plaintiff had a legal right to compromise the claim and dismiss the action without the consent of his attorney. (3) That the petition for leave to continue the case was properly denied.

LIABILITY FOR INJURY TO GIRL ON RUNNING BOARD OF CROWDED CAR FROM CONDUCTOR BEING THROWN AGAINST HER BY POLE—NO CONTRIBUTORY NEGLIGENCE—CARE REQUIRED.

Horan vs. Rockwell (N. Y. Sup.), 96 N. Y. Supp. 973. Jan. 3, 1906.

The plaintiff, a girl of 17 years, got on the running board of a crowded car on a line operated by the defendant as temporary receiver. She held onto a stanchion of the car, but was injured by the conductor being thrown against her in consequence of being struck by a trolley pole 4 feet 5½ inches from the nearest rail, as he swung himself around somebody in passing along to collect fares. The fourth appellate division of the supreme court of New York holds that the plaintiff, being unable to obtain a seat in the car, was not guilty of contributory negligence in riding on the running board of the car. The defendant, having permitted her to ride on the running board and taken her fare as a passenger, was obliged to exercise extraordinary care to transport her to her destination without injury. Again, the court says that it may be assumed that there was no passageway in the car, and the only practical method by which the conductor could collect the fares was by passing along the running board. In this he was performing the duty required of him by the defendant. There were, therefore, two concurring causes which produced the injury to the plaintiff—one the overcrowding of the car permitted by the conductor, and the other his act in coming in contact with the pole. It will not be presumed that the conductor intentionally caused the injury to himself. Assuming that both acts were negligent, they were such that the defendant was responsible for his negligent acts.

IT IS NOT GENERALLY NECESSARY TO HOLD CAR STILL UNTIL PASSENGER IS SEATED—WHEN IT SHOULD BE DONE—THAT A PERSON IS LARGE AND FLESHY DOES NOT ALONE NECESSITATE IT.

Bennett vs. Louisville Railway Co. (Ky.), 90 S. W. Rep. 1052. Feb. 20, 1906.

The plaintiff alleged that the motorman stopped the car for her, and that as she entered the door of the car and was in the act of taking her seat the motorman negligently turned on the current and started the car with a sudden and unusual jerk by which she was thrown with great force and violence against the end or edge of the seat and injured. The jury was instructed that it was not necessary for the agent in charge of the car to have it remain standing until the plaintiff was seated. The court of appeals of Kentucky approves of this instruction. It says that it can see no reason why the same rule should not be made applicable to street railways as to steam railways. It would be impracticable to require in every instance those in charge of a street car to have it remain still until every passenger that boards it takes a seat. This would make street car travel slow, vexatious, and inconvenient. There are instances in which a car should be permitted to remain still until the passenger is seated; that is, where the passenger is old, feeble, crippled, or in any condition which makes it reasonably apparent to those in charge of the car that the person needs unusual care and precaution for his or her protection. But this case did not come within that rule. It was true that the plaintiff was proven to be large and fleshy, but there was no proof that her flesh was any great burden to her, nor was there anything proven which might have indicated to the motorman in charge of the car that any extra precautions were required on his part for her safety.

LIABILITY FOR INJURY TO PROPERTY FROM OPERATION OF POWER HOUSE AND ELECTROLYSIS.

Townsend vs. Norfolk Railway & Light Co. (Va.), 52 S. E. Rep. 970. Jan. 18, 1906.

The contention of the plaintiffs was that in the operation of its plant the defendant wrongfully caused smoke, dust, cinders, sparks, and soot from its chimney stacks to be thrown and propelled upon and through the houses of the plaintiffs; that by the operation of its heavy machinery it caused the houses of the plaintiffs to be greatly shaken and damaged; and that by permitting the electric current from its wires and conduits, or on return circuit, to escape from its wires, or returning by the ground circuit, to run over and through the pipes placed to carry water and gas to the houses of the plaintiffs, the pipes had been eaten up and destroyed; and the useful and proper enjoyment of the property had been impaired, it had been rendered untenable, and its value diminished. The defendant, by special plea, replied that it had operated, and continued to operate its plant in a proper, careful, reasonable, and suitable manner, in pursuance of legislative and municipal authority conferred upon it. The supreme court of appeals of Virginia holds that a demurrer to the plea should have been sustained.

The declaration, the court says, set forth a nuisance. The defendant justified what it had done by pleading legislative authority for its acts. But a public service corporation is to be considered in two aspects. It has duties which it owes the public, and which it must perform. It has other duties not of a public nature which are incidental to those of a public character, in the performance of which it stands upon the footing of a private corporation. With re-

spect to the duties of the first class, it may be said that, in doing that which under the law it may be required to do, it cannot be considered as doing an unlawful act; and if a lawful act be done without negligence, any injury which it occasions is damnum absque injuria (that kind of damage for which an action will not lie). It is true that an electric railway cannot be operated without a power house; it is true that an engine house is a necessary adjunct to a steam railway; but they are incidents to the operation of the road, with which the public has no concern.

HOLDER OF NOTES PROMISED BONDS WHEN AUTHORIZED BY RAILROAD COMMISSIONERS NOT ENTITLED TO RIGHTS OF EQUITABLE BONDHOLDER.

Augusta Trust Co. vs. Federal Trust Co. (U. S. C. C., Mass.), 140 Fed. Rep 930. Nov. 16, 1905.

Under the laws of Massachusetts, the United States circuit court, in Massachusetts, says: A street railway company cannot issue bonds without the approval of the board of railroad commissioners, whose powers and duties respecting such issues are carefully defined by statute. In this case the petitioner held certain notes of a street railway company, each of which notes contained an agreement that, if the note was not paid at maturity, the railway company would deliver to the holder a certain number of first-mortgage bonds when authorized by the board of railroad commissioners. The bonds described in these notes were never authorized by the railroad commissioners, and consequently were never issued or delivered to the petitioner. But about two years before the notes matured the railway company executed a mortgage deed of trust to secure an original issue of first-mortgage bonds to the amount of $75,000, and additional bonds not exceeding $425,000, "as duly authorized by law and votes of the stockholders of the railway company." And the question was presented whether, under the agreement contained in these notes, the petitioner had the right to come in under the mortgage just as if it were the actual holder of the first-mortgage bonds described in the notes; in other words, to share in the benefits conferred by the mortgage security equally with the actual bond holders. The petitioner advanced the proposition that under this trust indenture there might exist, not only legal bondholders, whose bonds had been authorized by law, but equitable bond holders under the agreements contained in these notes. But the court holds otherwise. It says that for the court to accept this proposition would be to lay down the principle that a street railway company in Massachusetts may first execute a mortgage, and then, in direct violation of the state statutes, may proceed to issue bonds to the amount named in the mortgage under the form of contracts embodied in its promissory notes. This is in effect taking the control of street railways out of the hands of the state, by permitting them in this way to annul the laws which the state has passed for their proper regulation. This contract does not create a lien of any kind upon the property of the railway company. It is a mere agreement to deliver certain specified bonds when authorized by the railroad commissioners. Until this condition is fulfilled, the holder of these notes does not acquire any right, legal or equitable, in these bonds, nor any privilege to come in under the mortgage with the actual holders of bonds duly authorized under the laws of Massachusetts.

REQUIREMENTS MADE OF FOREIGN CORPORATIONS DESIRING TO OPERATE LINE IN KENTUCKY OR TO CONDEMN LAND OR ACQUIRE A RIGHT OF WAY THERE.

Evansville & Henderson Traction Co. vs. Henderson Bridge Co. (U. S. C. C. A., Ky.), 141 Fed. Rep. 51. Oct. 14, 1905.

Section 841 of the Kentucky Statutes of 1903 provides that no foreign corporation "shall possess, control, maintain or operate any railway or part thereof" in Kentucky, without first complying with its provisions—that is to say, being incorporated in the state by filing in the office of the secretary of state a copy of its charter or articles of incorporation. But section 765 provides that "No railroad corporation, organized or created by or under the laws of any other state, shall have the right to condemn land for, or acquire the right of way for, or purchase or hold land for its depots, tracks, or other purposes, until it shall have first filed in the office of the secretary of state of this state, in the manner provided in the first article of this chapter, its acceptance of the constitution of this state, and shall have become organized as a corporation under the laws of this state, which it may do by filing in the offices of the secretary of state and the railroad commission articles of incorporation, in the manner and form provided in section 763 of this article." Section 202 of the state constitution provides that "No corporation organized outside the limits of this state shall be allowed to transact business within the state on more favorable conditions than are prescribed by law to similar corporations organized under the laws of this commonwealth." And section 763 of the Kentucky Statutes requires a domestic corporation, organized to construct a railroad, not only to file its articles of incorporation, but proof that at least $250 per mile has in good faith been subscribed, and 20 per cent thereof paid in cash before it can proceed to business.

The traction company claimed that it had become a body corporate by complying with the provisions of section 841 above mentioned, but the United States circuit court of appeals, sixth circuit, holds that, not having complied with the provisions of sections 765 and 763, it could not maintain this action, which in effect was to acquire a right of way over the bridge owned by the defendant, a Kentucky corporation, upon terms to be fixed by the court. It says that a corporation which simply desires to maintain and operate its line in Kentucky, must become a corporation, citizen and resident of Kentucky, by filing in the office of the secretary of state, and in that of the railroad commission, a copy of its charter or articles of incorporation, by virtue whereof it at once becomes such corporation, citizen and resident. This is not the organization so much as the naturalization of the foreign corporation. Compliance with this section does not create a corporation subject to the organization tax of Kentucky, or deprive the foreign corporation thus naturalized of the right to sue or be sued in the federal courts as a citizen of another state. But a foreign corporation which desires to condemn land and acquire a right of way in Kentucky, must do something more than merely file there its articles of incorporation. Indeed, the provision of section 202 of the constitution would seem to forbid the preference which would result from permitting a foreign corporation to condemn land and acquire a right of way in Kentucky without filing proof that it is something more than a mere paper corporation, that its stock has been subscribed and paid in at least to the amount required of a domestic corporation.

STREET RAILWAY COMPANY NOT BENEFITED BY RELEASE GIVEN STEAM RAILROAD COMPANY BY ONE OF ITS EMPLOYES INJURED BY LOW WIRES.

Chapman vs. Pittsburg Railways Co. (U. S. C. C., Pa.), 140 Fed. Rep. 784. Sept. 27, 1905.

The plaintiff, a brakeman on a freight train, was injured where the latter ran under a defendant's trolley wires owing to such wires, or those used to guy them, being placed, it was alleged, too low. He obtained a verdict against the defendant, and the question was raised as to whether a release given by him to the steam railroad company, and the payment to him of money therein recited, took from him the right of action against the defendant. The United States circuit court, in Pennsylvania, holds that it did not. It says that the negligence of the defendant averred in the statement and established by the proof was the act of placing its wires an unsafe distance above the steam railroad tracks. This was a positive act of commission, in the doing of which the steam railroad company had no part. It might be that the latter company was also liable to the plaintiff in failing to notify him of the presence of the wire, but such liability, if it existed, was based on different grounds, namely, a negative act of omission by the railroad and not a positive act of commission. It sufficed to say that it was not shown that the steam railroad company was liable as a joint tort-feasor (wrong-doer), and in the absence of such proof, the burden of which was on the defendant, a release of the steam railroad company by the plaintiff did not release the defendant.

Not only was this the case, but to allow the release to nullify the verdict would be unjust and inequitable on other grounds. It was not contended that the release deprived the defendant of any right it possessed or subjected it to any additional burden or liability. The proofs showed that the plaintiff contributed in wages

toward the maintenance of the relief department of the steam railroad company. In case of accident or sickness of an employe, he draws relief from this fund without reference to the question of liability by the company. Before paying such indemnity, the company requires, in pursuance of a previous agreement, a release from liability by the employe, which agreement the supreme court of Pennsylvania has held is not void as against public policy. And by the terms of the release itself it appeared that nothing was paid the plaintiff, except the indemnity due him from the fund, and that nothing was paid for the release. Moreover, the testimony was uncontradicted that the money was paid and received and the release given with the understanding by both parties that it was not to affect the rights of the plaintiff against the street car company. It would therefore appear that he had never received any satisfaction from any source for the injury he sustained. To hold that the release given when the indemnity was paid him worked a satisfaction of his claim against the defendant would be to give the paper an effect which neither the parties or legal principles ever contemplated.

NOT LIABLE FOR ACCIDENT TO PITMAN—BURDEN OF PROOF ON PLAINTIFF AND AS TO CONTRIBUTORY NEGLIGENCE—DEFECT CANNOT BE INFERRED FROM INJURY—PRESUMPTIONS AS TO CONTRIBUTORY NEGLIGENCE AND PERFORMANCE OF DUTY.

Looney vs. Metropolitan Railroad Co. and Washington Railway & Electric Co. (U. S.), 26 Sup. Ct. Rep. 303. Feb. 19, 1906.

The Metropolitan company used the underground system by means of a "plow," so called, projecting through a slot in the tracks to an underground current, and it also had a trackage arrangement whereby its cars ran over a line of the other company, requiriing the cars to be equipped with a trolley pole and mechanism for an overhead system, in addition to being equipped with the "plow" and mechanism for the underground system. To attach these mechanisms to their respective systems the cars would be run over a "pit," which would enable a "pitman" to remove the "plow" from a car to be transfered from the underground system, and to adjust or attach the wires or "leads" necessary for the operation of the car over the other line. While doing this on one occasion a pitman was killed, and this action was brought by the administratrix of his estate to recover damages. A verdict was directed for the defendants and judgment thereon is affirmed by the supreme court of the United States.

The testimony, the court says, left no doubt that the pitman did not meet his death while removing the plow. He received the electric shock while adjusting the leads. It followed from the first proposition that the trolley pole was not in contact with the trolley wire when the plow was removed. Two questions arose on the second proposition. The leads were insulated except at the ends that went into the connection; they were necessarily uninsulated there in order to take the current. But it was not necessary for the pitman to touch the uninsulated parts in making the connection, and, unless touched, no shock would have been received, even though they had been connected with the current by reason of the trolley being in contact with the wire, unless there was a leak in the insulation arising from defective construction or wear and tear in use. Granting, therefore, that the conductor was negligent, one of two things was necessary to cause the accident—a leak in the insulation, or the act of the pitman in touching the uninsulated ends of the leads. Either one or the other was a necessary condition. If the first existed, the defendants might be charged with liability. If the second, they were exonerated. The burden of proof became a factor, and the plaintiff did not satisfy the requirements of the law in her proof.

The plaintiff in the first instance is not required to prove that the deceased was free from contributory negligence; in other words, the burden of proof of contributory negligence is on the defendant. But, on the other hand, the plaintiff must establish grounds of liability against the defendant. To hold a master responsible, a servant must show that the appliances and instrumentalities furnished were defective. A defect cannot be inferred from the mere fact of an injury. There must be some substantive proof of the negligence. Knowledge of the defect or some omission of duty in regard to it must be shown.

If there is no evidence which speaks one way or the other with reference to contributory negligence of the person killed, then it is presumed that there was no such negligence. But the negligence of a defendant cannot be inferred from a presumption of care on the part of the person killed. A presumption in the performance of duty attends the defendant as well as the person killed. It must be overcome by direct evidence. One presumption cannot be built upon another.

DUTY TO PASSENGERS—OCCUPATION OF SEAT FACING FENDER AT REAR—OCCASIONAL JOLTS TO BE EXPECTED—STATUTORY REQUIREMENTS FOR ACTION FOR LOSS OF LIFE—GROSS NEGLIGENCE—PASSENGER THROWN FROM CAR BY EXCESSIVE SPEED AT CURVE.

Spooner vs. Old Colony Street Railway Co. (Mass.), 76 N. E. Rep. 660. Jan. 5, 1906.

The plaintiff brought this action as administrator. The supreme judicial court of Massachusetts says that when his intestate became a passenger, the defendant engaged to provide proper facilities of transportation, including competent servants, and to carry him safely over its route to where, at the end of the transit, he would leave the car. In occupying the seat which faced the fender at the rear, and in taking the position which he assumed after seating himself, the man did nothing unusual or that could be found to have been inconsistent with ordinary prudence. The car, although an open one, was provided for the accommodation of passengers, who by this arrangement were invited by the company to choose and use this seat among others, and the man had the right to assume that in inviting and permitting its use it was suitable for him to occupy, and where he could ride in safety while being transported.

It is a matter of common knowledge that, either from inequalities of surface or necessary curves in the construction of the roadbed, the cars of a railroad operated by steam, or a street railway, may in passing over the track occasionally jolt or lurch, without this motion being caused by a defect in the track or in the car. Whenever this occurs, though it may be disturbing and annoying, yet it is considered as fairly incidental to the mode of travel, and must be held to have been contemplated by the passenger.

Section 267 of chapter 111 of the revised laws of Massachusetts provides that if the life of a passenger is lost "by reason of the negligence or carelessness of a corporation operating a street railway, or of the unfitness or gross negligence or carelessness of its servants or agents while engaged in its business," his personal representatives may recover damages for the use of the widow or children, to be assessed within a minimum and maximum limit, according to the degree of culpability. Inasmuch as there was no evidence in this case that the roadbed was not properly constructed, or the car suitably equipped or managed by competent employes, the plaintiff failed to show any act of negligence by the defendant under the statute, and if this, also, was true of the conduct of the motorman and conductor, the verdict rendered in favor of the plaintiff should be set aside. Exceptions, however, are overruled.

Upon taking his seat, the intestate, the court goes on to say, sat with his legs crossed below the knees, and his hands folded. While in this position he was observed by the motorman and conductor; the latter especially noticing that he "seemed quite exhausted." From this evidence the jury could find that both knew he was on the rear seat in the situation described. By reason of his weight and the distance from the outer rail of the track where his body was found, they further could have found that his ejection was due to the rapid swaying of the car. But ordinary carelessness by either the conductor or motorman, which, if he had survived, would have been sufficient to support an action against the defendant, is not gross negligence, for which the company is liable. This court has uniformly held that, while something more than a mere want of common prudence is intended and must be proved, yet the difference is one of degree, and when a reckless or willful disregard of consequence is manifest such conduct is evidence of great or gross negligence.

There was proof of a greater rate of speed than that fixed by the experts as safe for passing over the curve. And the court is of the opinion that it was open upon all the evidence for the jury to find that an old man plainly seen to be in somewhat feeble health had

been accepted as a passenger, invited and permitted to take a seat in a place provided for this purpose, but which might become dangerous if an undue rate of speed was maintained in passing over this curve, and thereafter in reckless or willful or wanton disregard of these conditions the car was so managed, and controlled by those in charge, as to wrongfully cause his death.

ATTEMPTING TO ALIGHT FROM MOVING CARS—CARE REQUIRED OF COMPANIES AS COMMON CARRIERS FOR SAFETY OF PASSENGERS—SUDDEN STARTING OF CAR WHILE PASSENGER IS ALIGHTING—APPLICATION OF DOCTRINE OF RES IPSA LOQUITUR—FALLING FROM CAR.

Paul vs. Salt City Railroad Co. (Utah), 83 Pac. Rep. 563. Nov. 27, 1905.

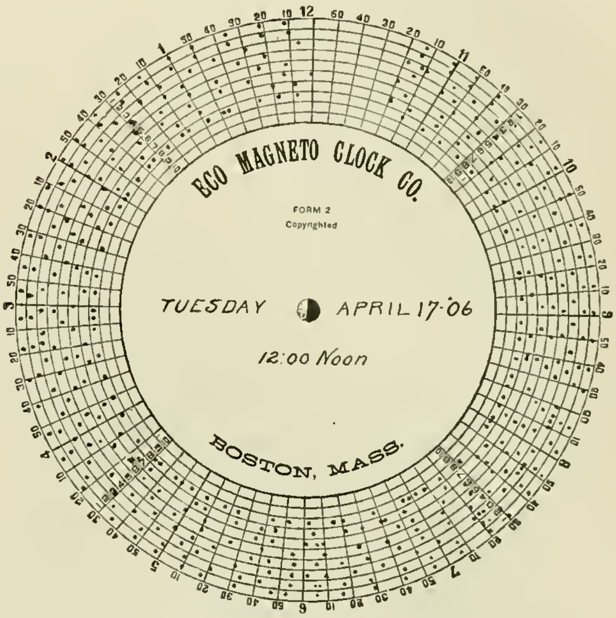
The law has become well settled, the supreme court of Utah says, that one is not guilty of negligence as matter of law in attempting to alight from a moving street car. In this case the jury were instructed: "It is the duty of a common carrier of passengers to give such passengers a reasonable opportunity to alight from its car, before starting the car; and if you find from the evidence that plaintiff, in the exercise of due care and prudence on her part, and while the car was standing still at a place where passengers might reasonably get off, was in the act of getting off from said car, and that the defendant, by its servants, started the car while plaintiff was so getting off, and before she had a reasonable time to do so, and without notice to her that the car was about to start, and thereby plaintiff was injured, then the defendant would be liable for the injury thus sustained by plaintiff." The plaintiff could not complain of this as far as it went, but it did not go far enough. The defendant would not only be liable under the facts therein stated, but likewise would be liable if, the car having slowed down in response to her notice of desire to leave the same, the plaintiff attempted to alight, and the speed and the surrounding conditions were such that the jury found it was not negligence to do so, and while making such effort to alight, the speed of the car was suddenly increased, by reason whereof she was thrown, and injured. Under the facts in the case it was not only the province of the jury to determine whether the act of the plaintiff in attempting to alight was a proximate cause of injury, but also to determine whether it was an act of negligence.

Street railway companies are common carriers of passengers, and, as such are bound to exercise for the safety of their passengers more than ordinary care. The many different forms of expression used in the text-books, and by the courts, in stating the rule as to the degree of care required of a carrier in conveying passengers, all recognize substantially the same test; that is the highest degree of care, prudence, and foresight consistent with the practical operation of its road; or, as it is sometimes expressed, the utmost skill, diligence, care, and foresight consistent with the business, in view of the instrumentalities employed, and the dangers naturally to be apprehended, and that the carrier is held responsible for the slightest neglect against which such skill, diligence, care, and foresight might have guarded.

The happening of the accident to the plaintiff, as described by her; that is, an injury visited upon her by a sudden start or jerk of the car while she as a passenger, was alighting therefrom, after it had stopped, in obedience to her request, to enable her to do so, constituted prima facie evidence of negligence under the rule "res ipsa loquitur" (the matter speaks for itself), and cast upon the defendant the burden of showing that the accident took place either without its fault, or through the contributory negligence of the plaintiff. Of course a mere fall of a passenger from a street car, or from the platform or steps of a car, without any evidence to show how it was occasioned, raises no presumption of negligence on the part of the street car company. But in case of a carrier and passenger the rule of "res ipsa loquitur" applies not only to cases of collision, derailing, and upsetting of coaches, breaking of machinery, appliances, and the like, but also to the doing of acts by the servants operating the machinery, and to the management of instrumentalities over which the carrier has control, and for the management of which he is responsible.

An Accurate Method for Recording the Headway on City Lines.

As a means of obtaining permanent records of the headways under which the city cars operate over the lines of the Terre Haute Traction & Light Co., Terre Haute, Ind., a novel and interesting method is used. The routes for the city lines are so laid out that all the cars pass a prominent street corner near the general offices of the company. At this street corner there has been erected on a pole at a convenient location, a suitable board with eight ordinary door-bell push buttons mounted on its face. Each of these buttons is electrically connected with a watchman's time clock in the nearby office of the company. The buttons are numbered and each route of the city cars has assigned to it a number corresponding with one of the buttons. As the cars pass this corner the motormen are required to deposit their transfers and tickets in a suitable box on the pole and at the same time push the button whose number



PERMANENT RECORD OF CAR HEADWAYS AT TERRE HAUTE.

corresponds with that of the route over which their car operates. The making of the electrical contact by pushing this button causes a perforation to be recorded on the paper within the time clock at the office.

By reference to the accompanying illustration, which is a reproduction of one of the records taken from the clock, it will be seen that these record blanks are ruled with circles, the spaces between which are numbered to correspond with the eight car routes, and with radial lines which mark off the hours and ten-minute divisions of the hours. The record also shows that it was placed in the clock at noon when cars were operating on all the lines. It will be seen that the cars of each route made their last trip past the recording corner at about 11:15 p. m. and that no regular cars were running between that time and 12 o'clock midnight when the next blank was put in the recording clock.

Such records should be of value from a legal standpoint as well as furnishing positive evidence of the degree of care exercised by the platform men in keeping their cars on schedule.

Consul Horton, of Athens, reports on the electric tramway extension for Athens and Piraeus, to be developed from the preseut horse and steam system by Franco-Belgian capitalists. Delay was caused in granting the new concession because of the change in the Greek ministry, all such matters having to be ratified by the Chamber of Deputies. The present 25-mile line will be transformed into a 30-mile electric line, with 60 per cent of it double tracked. The electrical apparatus will be American pattern, manufactured in Paris at the Thompson-Houston factory. Further information can be secured from G. S. Albanese, care the Greek Electric Co., Athens.

Signal System for the Electrical Zone of the New York Central.

An important advance in the art of signaling is shown in the work now in progress on the New York Central tracks in and near New York City.

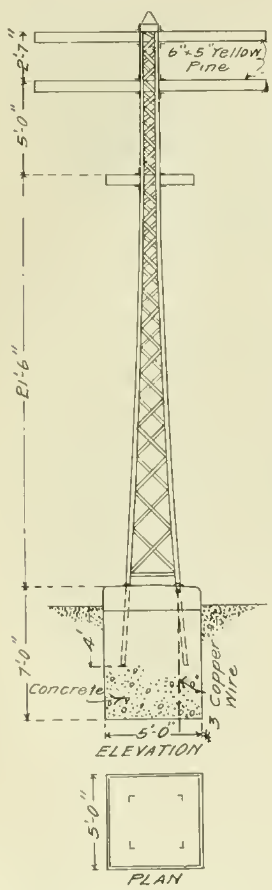
In comparing proposals for this work, the railroad company gave special consideration to safety and reliability and economy of operation, and also to quickness of delivery and erection, and the selection of the system to be installed was made only after the most systematic and careful deliberation.

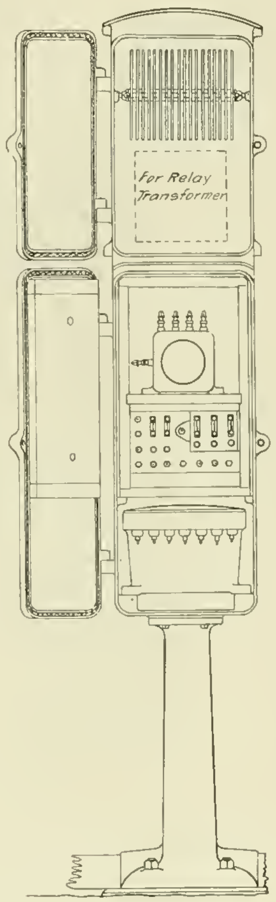
The system offered by the General Railway Signal Co., Buffalo, N. Y., and known as the "Young" system, was adopted. Alternating current is used for track circuits in connection with reactance bonds, permitting the passage of the direct propulsion current freely through both of the running rails, while impeding the alternating current used in signaling. This 2-rail system was deemed best suited to the conditions.

The work included by the contract covers what is known as the "electric zone," extending from the Grand Central Station to Croton, on the Hudson Division, a distance of 35 miles, and from Mott Haven to White Plains, on the Harlem Division, a distance of 19 miles. Throughout this distance there will be four main tracks, and the work includes about 3,000 interlocking levers and 1,400 track circuits, aggregating about 250 miles.

The work to be undertaken at the present time covers only that portion of the road to be equipped this year, which carries the work from the Grand Central Station to High Bridge on the Hudson Division, and to Wakefield on the Harlem Division.

The two main power stations at Port Morris and Yonkers will deliver 3-phase alternating current of 25 cycles and 11,000 volts

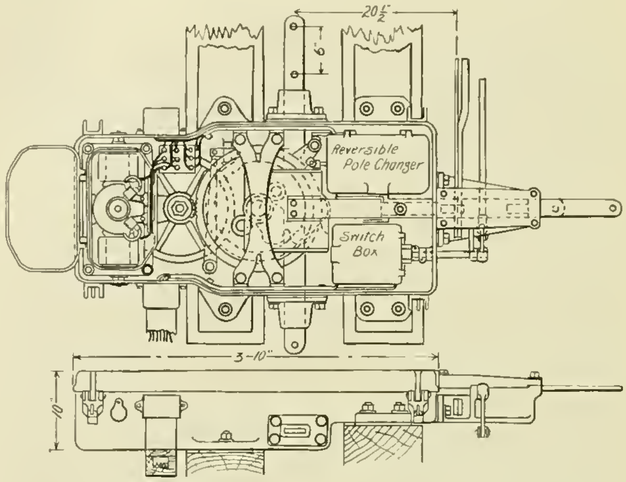




TRANSMISSION LINE POLES. RELAY AND TRANSFORMER BOX.

pressure, and there are various sub-stations at which this current is transformed and converted to direct current at 666 volts for delivey to the third rail. These sub-stations are also equipped with the transformers for the signal service, delivering alternating current at 3,000 volts pressure to the signal transmission line, which, although extending the entire length of the district to be signaled, is cut half way between each pair of sub-stations, thus making that portion of the line fed by each sub-station entirely independent of the adjoining one.

The apparatus in each sub-station is properly protected with automatic and hand-operated switches, and in order to insure operation, should the alternating current fail, the motor generators tak-



SWITCH MOVEMENT DESIGNED TO FIT UNDER THE THIRD RAIL.

ing current from the storage battery system installed in each sub-station for use of traffic will continue to feed the signal transmission line with alternating current, and the signal system will continue to work under all conditions under which traffic will be operated. A synchronizer is installed between the transformer and the motor-generator set.

The 3,000-volt transmission line consists of No. 0 bare copper wire, carried on the pole line and in the conduits used for the main transmission system. Signal bridges are equipped with extension brackets, with cross arms, for convenience in running wire lines to signals.

For the operation of signal circuits, signal motors, indicators and signal lighting, the 3,000-volt current is stepped down to 50 volts, through transformers placed on signal bridges or transmission line poles. The secondary of the transformer is provided with a ground connection.

For track circuit operation the voltage depends on the length of track circuits, and varies from one and one-half volts for circuits of 200 ft. to eight volts for circuits of 5,000 ft. The reduction from 50 volts to the track voltage is made by a transformer provided with four taps, which arrangement of connections will permit of one type of transformer being used on all track circuits.

In laying out the block signaling plan, the length of the block was determined by the braking distance. For speeds not exceeding 45 m. p. h. the blocks were made 1,200 ft. long; for speeds between 45 and 60 m. p. h. 2,500 ft., and for speeds over 60 m. p. h. 3,000 ft., the average length of the long blocks being about 3,200 ft. All blocks have a full block overlap. A distant signal is provided for each home signal. On account of the density of traffic and the necessity for quick operation the clearing time is limited to three seconds.

Where the track circuits are 500 ft. or less in length, and where the drop in potential in the length of the track circuits is not greater than 50 volts, the "1-rail" system is used. One rail of the track is given up for signaling purposes. There being no direct current on the signal rail, it is not necessary to use any reactance bonds.

The insulated rail joints are of the Weber pattern, with a steel angle-plate on the inside.

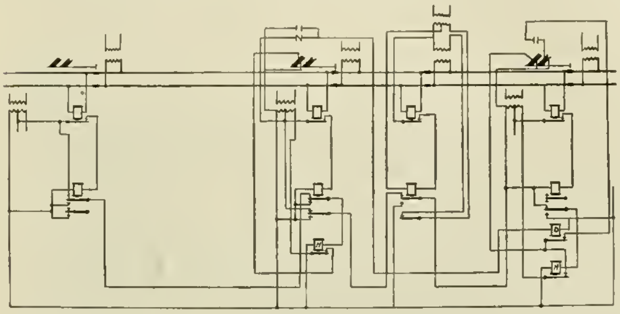
On track circuits between 500 and 1,600 ft. long, the "2-rail" system is used, and the reactance bonds consist of a copper bar one inch in cross section and 30 ft. long, coiled in eight turns around an iron core. For track circuits over 1,600 ft. long a reactance bond formed of a coiled copper bar without any iron core is used.

It will be seen that the block sections are of two types, the 1-rail and the 2-rail systems. In the former the propulsion current flows along the continuous rail, and in the event of a defect in the continuous rail, this current must avail itself of the conductivity of adjacent tracks, through cross bonding. In sections of the 2-rail

system each of the traffic rails of a track forms separate and independent conductors so that if one rail is interrupted, the other would act as a return conductor, even if there were no cross bonding to adjacent tracks.

The use of two styles of bonding was determined by the cross bonding for the electric traction system. The engineering department of the railroad determined that the distance between such cross bonds should not exceed 1,600 ft.

All of the reactance bonds are enclosed in water-tight cast iron



TYPICAL SIGNAL CIRCUIT OF NEW YORK CENTRAL ELECTRIC ZONE.

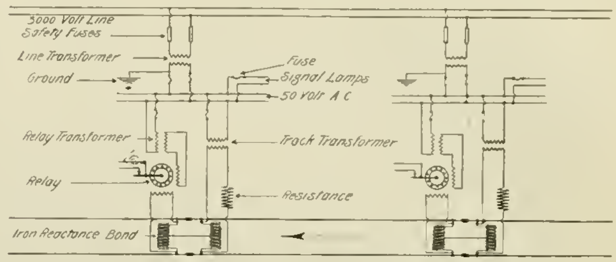
boxes, set on foundations, the boxes being filled with oil to carry off the heat generated. The bond is designed to permit the continuous passage of 3,000 amperes for each rail of the track without injurious heating. The casing of the box is made to cover the terminals and connections to the rail to keep them from being tampered with.

The track relay is of the induction motor type, with two field coils. One coil is energized by the 50-volt signal operating current which gives the greater part of the energy required to magnetize the fields and armature. The other coil is energized by the current from the track rails, and this current need only be strong enough to give sufficient magnetism to rotate the armature. The armature revolves through an angle of 37½ degrees, during which movement the contacts are separated through 23½ degrees, and made up through 14 degrees, thus giving a good rubbing contact.

The signals are to be of the General Railway Signal Co's. motor-operated type, with mechanism placed in the base of the signal mast, signal. The signal lamps are provided with an electric light attachment. The lamps are of four candlepower, working on a 50-volt circuit, and are connected in parallel, with a fuse cut-out, to allow any lamp to be disconnected, without affecting other lamps supplied on the same circuit. The filament of the lamp is wound in a small circle, to bring the point of maximum illumination within the focus of the lens.

The signals to be used in the Park Ave. tunnel will consist of lights only, without any moving parts whatever.

The interlockings are of the standard type, manufactured by the General Railway Signal Co., in which direct current furnished from



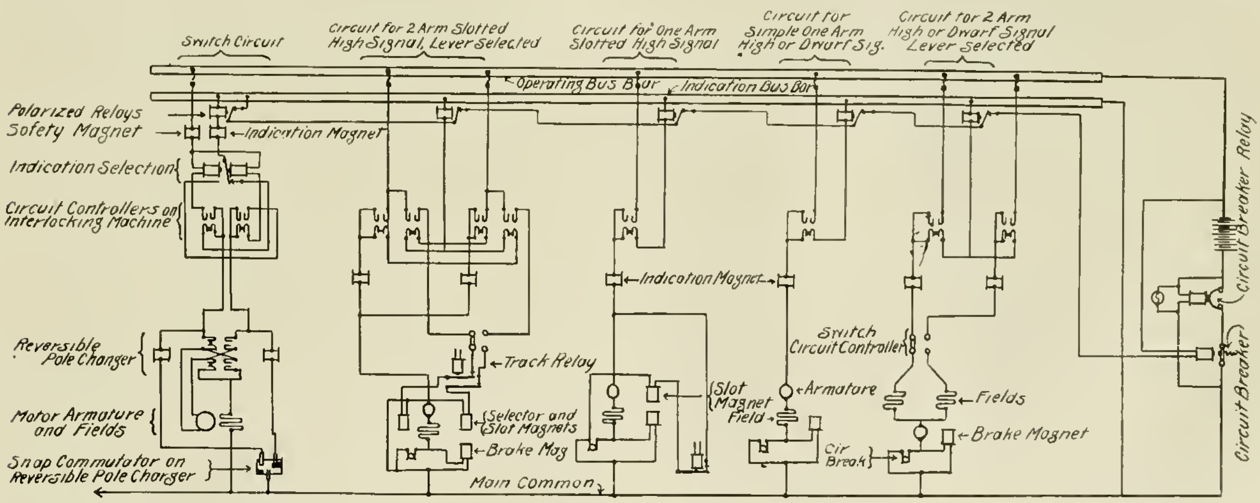
TYPICAL TWO-RAIL CIRCUIT WITH CORED REACTANCE COILS.

storage batteries is used to operate the switch movements and signals. As usual with this type of apparatus the indication is given by the current formed by the motor, which on completing its stroke at the signal or switch movement is changed to a generator and gives sufficient current to release the lock of the lever of the machine. The typical interlocking circuits are shown.

The storage battery which supplies current for the interlockers consists of 55 cells, of capacity varying from 80 to 320 ampere hours, according to the number of daily lever movements to be made. The average time between charging will be four days.

The interlocking machines are of the usual type and are provided with a latch for each lever to require a definite action on the part of the operator to change the position of the lever. The lever handles are colored according to their functions. There will be a separate lever for each high signal arm and no selectors will be used.

The interlocking signals will be of the General Railway Signal



SIGNAL BRIDGE WITH CROSS ARM EXTENSION.

and worked by a single phase alternating current motor of ¼-h.p. capacity, using current at 50 volts pressure.

The signals are of the 60-degree, 2-position type, using New York Central standard spectacles and blades, which impose on the signal motor a load equal to the lifting of a 17-lb. weight, at a distance of 4 ft. from the center of the shaft. With this load the motor will clear the signal in from two to three seconds.

The circuits by which signals are controlled are shown in an accompanying figure, which calls for a full block overlap, and the control of the distant signal through a circuit breaker on the home Co's. type, with dynamic indication-current return. These signals, where slotted, will return to the stop position when the current through the slot magnet is open, but the return indication from the signal motor is not received at the lever until the lever is first restored to the normal position. The operating circuits for the signals are run through controllers on all facing switches in the main line, insuring that the switches are properly set before the signals can be cleared. Block signals on the same mast with distant signals are controlled by a lever in the machine requiring the block signal to be changed to the stop position before a signal can be cleared

for a reverse movement on the main line. The advance signals for each track, although operating as automatic block signals, are controlled from the interlocking and are provided with a square end blade to enable the signalman to hold a train, if it is desired to do so. Approach locking will be provided for all main line switches. This locking becomes effective when a train has reached a point at least one mile in the rear of the distant signal.

A counter reading to five figures is to be placed on all high signals to register the number of movements.

The movement to be used to operate the switches is of an entirely new type. With the small clearance under the third-rail contact shoe, a mechanism that will not project above the top of the running rail is absolutely necessary. This movement is enclosed in a neat casing with the gear and escapement crank horizontally arranged.

The movement is fitted with an improved locking device which will prevent the motor from forcing the plunger through the lock rod in case it should not have come to the proper position.

The type of dwarf signal to be used is a new one, the signal arm being moved by a motor mechanism arranged horizontally at the base of the post.

In this installation the use of detector bars is practically abolished, a few only being used on the outside rail on sharp curves. Short electric track circuits are provided in their place. The use of these short track circuits with the controlling wires to the interlocking machine makes possible, at small expense, the use in the interlocking tower of an illuminated track indicator consisting of a track plan of the interlocking painted on a piece of ground glass, with the track circuit sections divided on the back of the glass into separate compartments in which are a red and a white electric light. When the track section is occupied a red light will be shown on the indicator plan, and when unoccupied a white light will be shown.

In places like the Grand Central terminal, where the tracks will be entirely roofed over, it will not be possible for the signalman to observe the movements of many of the trains, and an indicator of this kind is an absolute necessity to enable him to keep in touch with the situation. The preliminary installation, now under way, controlling the movement in the east yard of the Grand Central terminal, will be used as a temporary terminal during the completion of the remainder of the yard.

As in the Park Ave. tunnel, the signals in the Grand Central station interlocking will be shown entirely by lights, without any blades or moving parts. In this interlocking work, however, the lever for the signal completes the circuit for the lamps to give the proper color for the indication required.

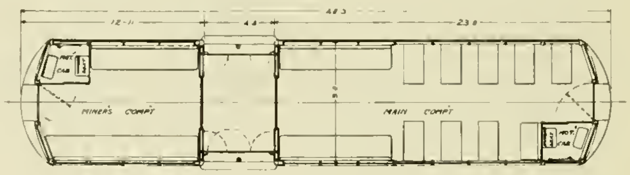
The Sandy Valley Traction Co. has been formed to build a line from Lisbon to New Philadelphia, O., with spurs extending from Magnolia to Canton, O., and from Minerva to Alliance, O. The road will be 70 miles in length and is capitalized at $1,500,-000.

Side Entrance Cars for the Wilkes-Barre & Hazelton Railway Co.

The accompanying illustration shows one of a shipment of 10 double-truck, semi-convertible cars which were built for the Wilkes-Barre & Hazelton Railway Co., by the Jewett Car Co., Newark, O. An interesting feature of these cars is found in the position of the vestibule which is located in the center of the car, thus dividing the car into two separate compartments. Since the cars are to be operated through the coal mining district about Wilkes-Barre, the smaller of these two compartments is reserved for the use of miners. This compartment is plainly furnished and finished so that it may be easily cleaned. Longitudinal slat seats are provided on either side of the compartment.

A COMPLETED ORDER OF CARS FOR THE WILKES-BARRE & HAZELTON RAILWAY CO.

The main compartment is finished in cherry and has nine cross seats of the "walkover" type upholstered with rattan. Two longitudinal seats are placed on either side of one end of the compartment. A motorman's cab is located at either end of the car and is entirely enclosed, thereby shutting off the motorman from all communication with the passengers. An end door is placed in either end of the car to provide for the operation of the cars in train. The cars are heated by means of electric heaters and are equipped with Climax headlights, air sanders and air brakes.



FLOOR PLAN OF JEWETT CAR FOR THE WILKES-BARRE & HAZELTON RAILWAY CO.

The dimensions of the car are: Length over all, 40 ft. 3 in.; width of car body, 9 ft.; length of miners' compartment, 12 ft. 11 in.; width of vestibule, 4 ft. 4 in., and length of main compartment, 23 ft.

The statistics of the Pennsylvania Railroad Pension Department, compiled as of Dec. 3, 1905, show that during the six years of its operation there has been authorized to be paid in pension allowances to the retired employes of the company the sum of $2,004,-087.59. This expenditure does not include the expenses of operation of the department, which is also borne by the company.

The Hannibal Railway & Electric Co., Hannibal, Mo., will build a scenic interurban railway along the banks of the Mississippi River from Hannibal to Ilasco, during the present year. In addition to serving the population of the terminal cities the railway will afford a means of travel to and from Mark Twain cave, which is located about one and one-half miles from Hannibal. The cave is a popular resort during the summer months.

A Valuable Demonstration in Steam Turbine Design.

There was recently installed at the Kent Ave. station of the Brooklyn Rapid Transit Co.. a 5,500 kw. steam turbine, the makers of which claimed certain superiority of design in various details. It now transpires that this turbine has been operating for a considerable time under conditions tending to subject it to abnormal strains of an unforeseen and severe character. Summed up briefly, this turbine was run daily from March 30th to April 25th, with a knife leaf wedged in between the rotor and stator, and the latter part of the time with the shrouding of the blades grinding against the stator. Yet when opened up, no destruction of the parts had occurred and no distortion of the blading. Considering the high speeds and centrifugal strains involved, such a result is rather remarkable.

Such an operating condition as the foregoing does not, of course, need to be taken into consideration in steam turbine design, but the result would seem to show that this form of construction overcomes the difficulties and dangers arising from attempts to secure a minimum steam clearance between rotor and stator, a point upon which high efficiencies depend. The steam turbine referred to is the product of the Allis-Chalmers Co.

Although the turbine had been run only a few days at reduced speed to dry out the generator and had never been operated under

POCKET KNIFE TAKEN FROM A 5,500-KW. STEAM TURBINE.

load, it was found necessary to put it into commission to meet urgent demands for power on March 27th, and as fast as additional boilers could be fired up, the load was increased until the peak for the first day was reached at over 4,000 kw. On succeeding days the demands of the service reached 7,000 kw. Service was resumed on April 1st for the morning and afternoon peak loads, and has since been continued daily without interruption excepting a short stop on the morning of April 25th which was due to the incident referred to at the beginning of this article.

Shortly after starting up the turbine on the morning of April 25th, a peculiar noise was heard in the turbine cylinder, and the turbine was therefore stopped and opened. It was found that a piece of steel had gotten between the spindle and the shroud of the first row of stationary blades and, acting like a lathe tool, had cut into the body of the drum for a width of about three-eighths of an inch, and for a depth of nearly three-sixteenths of an inch, this cut being alongside of and opening into the groove which holds the first row of spindle blades.

This had loosened the calking strip which held the ring of blades in place. For a distance of five or six inches this strip had come partly out of its groove, thereby loosening the ring of blades. This latter, under the influence of centrifugal force, had bent outward so that the channel shaped shroud ring had rubbed hard in the bore of the cylinder. This rubbing had been so severe that the flanges of the shroud ring had worn almost down to the heads of the riveting which holds the shroud ring to the blades.

New Publications.

SHAFT GOVERNORS, by W. Trinks and C. Housum, 97 pages, bound in board, price 50 cents; published by the D. Van Nostrand Co., 23 Murray and 27 Warren Sts., New York City. This publication deals with the theory and practice of shaft governors and illustrates the wide difference existing between actual practice and superficial theory. Purely descriptive matter seems to have been avoided as much as possible and the different forces which should be considered in designing shaft governors have been treated mathematically. Numerous formulas are given which are for the most part of a general nature. It is evident that considerable thought has been given to the compilation of this work and designers and builders will find in it much information which they have hitherto been unable to obtain outside of actual practice.

PART TWO OF TYPES AND DETAILS OF BRIDGE CONSTRUCTION, by F. W. Skinner, 410 pages, bound in cloth, price $4.00; published by the McGraw Publishing Co., 114 Liberty St., New York City. This work treats of and illustrates the essential features of calculation, design and manufacture of plate girders in the United States, and is a presentation of advanced practice in bridge construction in its principal details. The book is arranged in parts, each dealing separately and completely with a distinct portion of the subject. First, the general features of plate girders are outlined, their loadings and methods of calculation reviewed, the essential requirements of loading specifications noted, methods of design explained and illustrated, well developed systems of making and preserving drawings and records are given, present construction and erection methods are described, and data given of full-sized practical tests. In the succeeding parts numerous examples are given of bridges, most of them of recent construction for leading railroads in America, including straight and skewed through and deck spans of from one to four tracks, with numerous examples which show locations, conditions, requirements, general dimensions, materials, the principal structural features and any details of deviation from ordinary practice, thus covering most of the features involved in standard railroad design and the differentiations due to individual design and varying shop practices. The treatise concludes with a series of discussions by prominent engineers and builders of experience and ability, who review the features of plate girder use and construction; explain those which they consider the most important; describe methods of computation, design, service and features of shop and mill practice. In connection with the numerous examples of plate girders, these disinterested, expert conclusions are of much value and add greatly to the usefulness of the book.

POOR'S RAILROAD MANUAL APPENDIX AND DIARY FOR 1906. 283 pages, bound in cloth, published by Poor's Railroad Manual Co., 68 William St., New York City. This publication contains much valuable tabulated information concerning steam and electric railways. A reference bond list of the leading steam railroads in the United States is given, which has been compiled from official returns to Poor's Manual. The list includes a description of the bonds, the date of maturity and the amount outstandiing on or about December 1, 1905, the property covered includes the termini of the roads, miles of track, amount of bonds outstanding per mile of road and the names of the trustees. A tabulated list is given showing the date of the close of the fiscal year, time and place of annual meeting, time of closing of transfer books, registrar of stock and transfer agents of the steam and electric railroad companies in the United States, Canada and Mexico. There is also a tabulated list showing the date of the close of the fiscal years of the steam and electric railroad companies in the United States paying dividends during the eight calendar years from 1898 to 1905 inclusive, with the rate per cent, place of payment, time of closing transfer books, etc. There are also included statistics of the steam railroads in the United States giving the length of the road owned and the length operated, capital stock, bonded debt, gross earnings and operating expenses from net income and payments from net income. The same information is given for street railways in the United States and in addition the number of the motor, freight and passenger cars owned by each road is included. The work concludes with a table of gross earnings tabulated by months from 1900 to 1905 inclusive for the leading railroads of the United States, a diary of the annual meetings and closing of the transfer books by months, and a table of the dividends usually paid each month.

MUNICIPAL OWNERSHIP IN GREAT BRITAIN, by Hugo R. Meyer. Published by the MacMillan Co., New York City, 340 pages, bound in cloth, price $1.50.

This is the second of the series of four books in which Professor Meyer promises to give the results of his investigation of the actual working of public regulation and government ownership and operation of the so-called public service industries. The present work treats mainly of the street railways and electric lighting, power and gas plants of Great Britain. The material has apparently been drawn from utterances of eminent men of that country and from the reports of committees appointed at different times by various branches of the British government. Almost universal restriction, by the governing bodies, of those enterprises whose service to the public depends more or less upon the use of the city's streets, and the poverty and inefficiency of the service resulting from severely restricted private initiative and sluggish municipal progress form the author's theme.

The tramways act adopted by Parliament in 1870 provided for the compulsory sale of the tramway company's properties and rights at the end of 21 years, on demand of the municipality, "upon terms of paying the then value (exclusive of any allowance for past or future profits of the undertaking, or any compensation for compulsory sale, or other consideration whatsoever) of the tramways and all lands and buildings...." It was under authority of this law that the street railways were constructed until the light railways act of 1896.

"For two reasons the tramways act of 1870 paralyzed private initiative. In the first place men soon learned that it takes time to build up an extended street railway system, and that the losses suffered in the early years of the venture cannot always be made up in the lifetime of a charter limited to 21 years, with provision for sale on the basis of the value of the material put into the plant. That lesson was learned so thoroughly that to this day English capitalists look askance at street railway ventures. Many of the largest and most promising schemes now being carried on in England are supported by American capital. The second reason for the disastrous working of the tramways act of 1870 is to be found in the abuse of the power of veto conferred on the municipalities, . . . It will be remembered that Mr. Shaw-Lefevre expressly stated that it was impossible to make the tramways both contribute to the public treasury and provide cheap and extended service to the public. None the less, the local authorities rarely gave their assent to the board of trade granting a provisional order to a company; they almost invariably sold it."

The results of this restrictive policy are seen in the timidity of capital entering the street railway field. In 1870, before the act was passed, there were 27 companies seeking to build 515 miles of main track. In 1880 only 386 miles had been built. "Had England and Wales possessed the same mileage of street railways as the United States in proportion to its population living in cities of 50,000 and more inhabitants, they would have had in 1880 no less than 1,875 miles of first main track of street railways." In 1890, had the cities of 50,000 and more inhabitants of England and Wales and of the United States had a proportionate mileage England and Wales would have had 3,190 miles, whereas in fact, England, Wales, Scotland and Ireland had only 948 miles.

Although the light railways act of 1896 is somewhat less restrictive, providing for three commissioners, who, with the consent of the Board of Trade, may grant authority to build light railways, making such provisions as they see fit, the supply of street railway facilities in Great Britain is still greatly inferior to that in the United States.

The author takes up the larger cities, showing their facilities and their needs, and making comparisons with the facilities of the cities of the United States. In 1889, at the close of the horse railway era in the United States, the author found in the city of Glasgow 61 miles of street railway tracks, and that year in Boston, which contained about 10 per cent fewer people than Glasgow, he found 231 miles of track. In 1904 Glasgow had one mile of track for each 6,700 people, while Boston had one mile for each 2,300 people. The purchase of the street railways by the municipality of Glasgow was made expressly with the intention of spreading out the congested population. In 1901 there were in Glasgow 91,205 persons living in the condition of three to 12 persons in one room, and 194,284 persons living in the condition of five to 12 persons in two rooms.

The number of overcrowded persons living in one room had increased during the decade from 1891 to 1901. "Thus far the corporation of Glasgow has failed absolutely to use the electric street railway for the purpose of 'suburbanizing the population.'" The author attributes this congestion to the system of graded fares, as well as to the absence of extended street railway systems. He finds the percentage of travelers at the different fares as follows: One cent, 20.4 per cent; two cents, 72.3 per cent; three cents, 6.2 per cent; four cents, 0.94 per cent; five cents, 0.06 per cent.

"The one-cent fare is a cheap luxury to the merchants, the professional men and the wives and daughters of those classes, when engaged in shopping expeditions, but is of serious consequences to the clerk and mechanic, who would like to move his family to the suburbs and finds the opportunity greatly restricted by reason of the one-cent fare."

In London the borough councils and the London County Council have so abused their power to veto franchises that in 1904 there was less than one mile of street railway track for each 16,800 people. The royal commission on the means of locomotion and transport in London is quoted as follows:

"Insufficiency of mileage is not the only defect of the tramway service in London. Within the county of London nearly the whole of the tramways are owned and in great part are worked, by the London County Council, whose policy has been consistently directed to the exclusion of private promoters from within the county of London; such tramways within their jurisdiction as do not already belong to them will be acquired, under existing statutory powers, in the course of a few years. In the districts of 'Greater London,' lying outside the administrative county of London, a different policy in general prevails; the tramways are largely worked by private companies. This difference of policy would not necessarily entail inconvenience if the systems on the outside were worked in harmony with those inside, so that cars could run continuously across the frontier. Unfortunately that is not the case. The systems, where they meet at the frontier, are not always physically connected, and in no case is there through running. Accordingly, every through passenger is obliged to change cars (and pay a new fare).

"Inside the county of London itself there are also very serious defects. Three systems of tramways are included in this area: The northern and eastern system, wholly north of the Thames; the western system, also wholly north of the Thames, and the southern system, wholly south of the Thames. All these three systems are separated from each other by long intervals, without any connection, while great districts in the center of London, including the city, the 'West End,' and the chief places of public resort, are entirely unprovided with tramway service. The different lines approach those districts and then break off abruptly in the middle of the street. As a result, all the cars are obliged to discharge their passengers at dead end terminals. At the six principal terminals nearly a quarter of a million passengers alight from or join the cars every day in the streets. Apart from the great inconvenience caused to all or most of the passengers, the result is a great congestion both of tramcars and of ordinary vehicular and passenger traffic at these terminal points; and the same congestion, though in a less degree, occurs at the other terminals in London."

Similar restriction of private initiative and the same inefficiency on the part of the municipality is found in the ownership and operation of gas plants, electric plants and power plants. The author concludes:

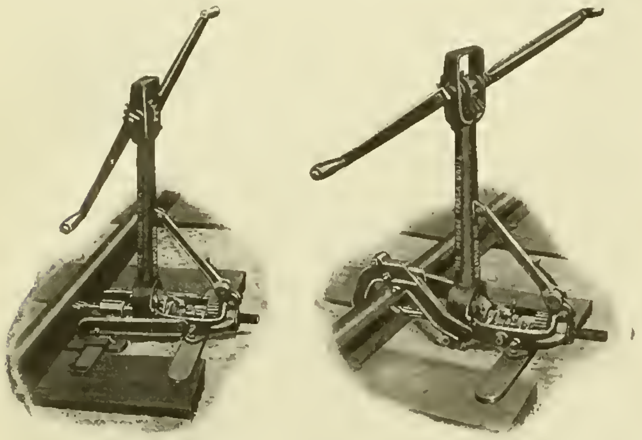
"The upshot of 35 years of action upon the doctrine that the public service industries that make use of the public streets differ from ordinary trading and manufacturing ventures and must be made to share their profits with the public at large is that the people of the United Kingdom have at their disposal about one-quarter the street railway facilities, one-third the electric lighting facilities and less than one-quarter the telephone facilities that they would have to have before they could be said to be as well supplied with these facilities as are the people of the United States."

The municipalities have thus been unable to build up new industries. They have waited until private initiative has made the industry profitable and then have used compulsion to obtain it. Having gotten possession, they have failed to extend the industry and have kept out of the field competing and substitute industries. The possession of horse car lines and gas plants in which the people's money was invested has been the basis of the hostility toward

electric lines and electric plants. The Englishman is not lacking in inventive faculties or in daring in the investment of capital, but he has been given no opportunity to keep pace with the American.

The Moore Rail Drill.

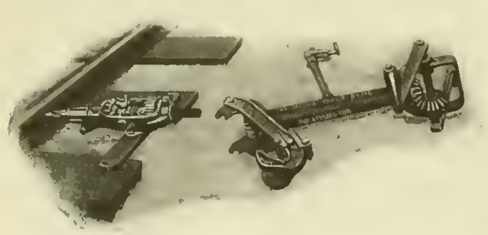
The Moore rail drill, of which illustrations are herewith presented, was designed to meet the requirements of heavy and severe work in railroad yards and on lines where it is not desirable to interrupt traffic. The portion of the drill above the head of the rail



THE MOORE RAIL DRILL SHOWING UNDER-CLUTCH AND OVER-CLUTCH ATTACHMENT.

can be easily detached to allow trains to pass and can then be as easily attached and work resumed with but a short delay. The drill can be equipped with either the under or over-clutch attachment, both of which are illustrated. Another illustration shows the drill dismantled to allow the passage of trains.

The drill has a variable feed which can be adjusted from nothing to the full capacity of the drill and is thus able to meet any requirement which may be placed upon it. By throwing the feed mechanism out of gear the drill can quickly be fed up to or returned from the work. The under-



MOORE RAIL DRILL WITH UPPER PART DISMANTLED.

clutch attachment is claimed by the makers to be a new feature and its use does not require any digging under the rail. By the use of ball thrust bearings on the spindle instead of friction washers, friction is reduced to a minimum.

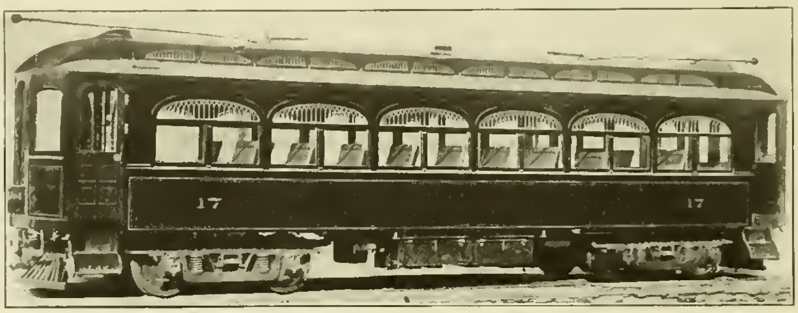
The drill is made in two sizes. No. 1 weighs 60 lb. and is designed for drilling holes of one inch and less, but has sufficient power to drill holes of 1⅛ and 1¼ in. No. 2 weighs 100 lb. and is recommended for continuous heavy work. The manufacturer of this drill, the Kalamazoo Railway & Supply Co., claims that it has been thoroughly tested in actual service and feels confident that it will meet the most exacting conditions.

Mr. C. F. Shelton, superintendent of transportation of the Ft. Wayne & Wabash Valley Traction Co., reports that the results obtained from the new limited service which has recently been inaugurated between Indianapolis and Ft. Wayne, have been most satisfactory. The buffet service is exceptionally fine and the charges are moderate. Mr. Shelton believes that within the next few months it will be necessary to increase the rolling stock in order to meet the demands of the public.

New Cars for the Philadelphia & West Chester Traction Co.

Seven fine interurban cars are now being placed on the lines of the Philadelphia & West Chester Traction Co., which lines connect the suburban towns of West Chester, Clifton, Garrettford, Llanerch and Ardmore with Philadelphia. This interesting system, as recently rebuilt, was described and illustrated in the "Street Railway Review" for September, 1905. The lines connect with the surface and the subway and elevated lines, now in process of construction, of the Philadelphia Rapid Transit system. The new cars, which were built by the J. G. Brill Co., show very clearly that the policy of the railway is to provide its patrons with all the luxury, as well as comfort, possible by using the most advanced forms of interurban equipment. As will be seen in the illustration, graceful design is combined with substantial construction.

The exteriors of the new cars are painted a rich maroon with simple stripings in gold leaf Below the windows, the sides and vestibuled ends are sheathed with steel. A very graceful arch surmounts the upper part of the twin windows and the ventilator sashes. The pleasing effect is increased by the arched row of green art glass, in small diamond sections, set in the leaded glass of the window heads. The same kind of glass is used for the ventilators. In the interiors a light green tinted dome of empire style decorated with gold festoons of ribbon contrasts in a pleasing manner with the rich dark red of the vermillion wood of the interior finish. The woodwork is richly and simply carved and inlaid. The trimmings are of bronze. Clusters of lights, shaded by frosted glass globes, are set at intervals in the dome and single lights are placed along the lower ventilator rails. The window sashes are arranged to be raised to their full height and have balance weights to make their operation easy. Between the larger compartment and the smoking compartment is a partition of vermilion wood with a sliding door, glazed in the upper part, and with windows on either side and a leaded glass transom above. The partition is arranged to be readily removed from the car if desired. The single sliding doors at either end and the vestibule doors are of vermilion wood. High-back seats of generous dimensions are upholstered in green leather. Interlocking rubber tiling covers the floor, and altogether the interior presents an attractive appearance.



NEW CAR FOR THE PHILADELPHIA & WEST CHESTER TRACTION CO.

The bottom framing of the new cars is entirely of steel and consists of angle iron side sills with extra wide sill plates; these sill plates take the place of inside and under trusses. The intermediate members and crossings are also of angle iron with large gusset plates over the needle beams. The flooring is composed of cement laid on galvanized corrugated iron and covered with interlocking rubber tiling. The general dimensions of the car are as follows: length over body, 36 ft.; length over vestibules, 44 ft.; width over sills, including side sheathing, 8 ft. 6 in.; height from rail over trolley, 12 ft. 3⅝ in.; centers of side posts, 2 ft. 10 in.; thickness of corner posts, 3⅝ in.; and thickness of side posts, 2½ in. and 4¾ in.

The cars are arranged for head-end train control and have doors in the vestibule ends to permit passing from one car to another. The cars are fitted with a pilot at each end. They are to be operated singly as well as in trains, and are designed to run in either direction.